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Identification of Some Philosophical Beliefs of Influential Leaders in American Physical Education[1]

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Abstract

The purpose of the study was to determine with what eminent educational philosophies the beliefs of contemporary professional leaders in American physical education are identified, and from the identification determine philosophical directions which seem to be indicated for American physical education. Data for the study were secured from responses to a checklist of philosophical-professional beliefs sent to a highly selected group of leaders in American physical education. The responses were tabulated with relation to the philosophical identity and intensity of beliefs, as well as the age, sex, and geographical location of the respondents. On the basis of present indicated beliefs, professional leaders are providing a predominantly naturalistic direction to American physical education, with evidences of spiritualistic beliefs exerting an influence in certain professional areas.

BELIEFS may represent guides which determine the direction of things to come. The beliefs of individuals, like those of a profession or nation, are significant as a body of concepts which provide the basis for a working philosophy. The identification of these beliefs should reveal the present status of thought and perhaps indicate directions of action for the future.

The purpose of the study was to determine with what eminent educational philosophies the beliefs of contemporary professional leaders in American physical education are identified, and from such identification determine the philosophical directions which seem to be indicated for American physical education.

Review of Related Literature

The study was approached through an examination of numerous publications that described the philosophical systems underlying present-day education and the forces which have shaped American physical education. Most of the literature related to his study was devoted to an analysis of philosophical differences in educational thought and practice.

Several authors have investigated the influence of social, cultural, and economic forces upon programs of physical education (1, 7, 10). In spite of an

[1]This report is taken from the findings of a study, made under the direction of Dr. Elwood C. Davis, and presented in partial fulfillment of the requirements for the Doctor of Philosophy degree at the University of Southern California.

early recognition of differences of belief within American physical education, it appears that there has been no previous attempt to identify beliefs in physical education with respect to philosophical position — namely, Pragmatism, Realism, Idealism, and Aritomism.[2]

Of the literature reviewed, none has provided physical education with any precise data concerning the educational beliefs of its professional leaders. Nor was there any evidence of earlier attempts to identify philsophically, with a view toward determining professional directions, the beliefs of American physical educators.

Procedure

In attempting to arrive at the educational philosophy of professional leaders in physical education, it was necessary to formulate an instrument suitable for determining the beliefs of contemporary physical educators, and to secure responses from a highly selected group of professional leaders.

Development of the instrument. The instrument developed to focus upon the beliefs of contemporary physical educators was comprised of 12 categories selected from background reading indicating areas from which rather basic beliefs could be drawn. The following categories were included: the universe, man, values, education, program building, program content, the administrator, the teacher, the learner, learning, teaching methods, and evaluation. Each category contained statements representative of four eminent philosophical positions—Idealism, Realism, Pragmatism, and Aritomism.

In addition to checking the belief which most nearly coincided with his own, each respondent was asked to indicate the intensity with which the belief was held—namely, strongly, moderately, or slightly. This differentiation appeared workable and was meant to augment the findings and interpretations of the study.

Method of selecting leaders. A two-way approach was used in selecting professional leaders in physical education who might be considered to be exerting a profound influence upon thinking in the field of physical education today. The initial approach was to utilize a screening device intended to identify those members of the American Academy who seem to be exerting the most profound influence in the profession. Since a well-defined list of professional criteria is operative in determining membership in the Amercan Academy for Health, Physical Education and Recreation, it was decided to use some of this group as the type of respondent desired. The degree of selectivity in the Academy membership is indicated by the fact that there are currently about 23,000 members in the American Association for Health,

[2]The fourth philosophical position covered in this study represents a combination of Aristotelian and Scholastic philosophy. Since the two philosophies are quite similar educationally, and differ primarily in theology, considerable difficulty was encountered in formulating statements of belief relating to physical education that differentiated clearly between the two positions. For purposes of this study, it was decided that Aristotelianism and Scholasticism be combined and referred to as Aritomism.

Physical Education, and Recreation and the Academy maintains an active membership of about 70 Fellows.

Three staff members of the Department of Health, Physical Education, and Recreation at the University of Southern California who were active members of the Academy, were consulted concerning active Fellows in the Academy who were currently exerting profound influences upon professional directions in American physical education, and who thus might be selected as qualified respondents. Independently-made selections by the three staff members were undertaken with some thought as to each candidate's professional leadership responsibilities, contributions to the professional literature, and honors and awards received.

The lists of names from each of the three staff members revealed considerable similarity, but only those names were selected which were mentioned by at least two of the three consultants. This procedure yielded 35 names of Academy members who were regarded as exerting a profound influence upon professional directions.

The second phase in the selection of leaders attempted to take into account non-members of the Academy who might be considered as very influential in determining professional directions in American physical education. Each of the initial 35 professional leaders was asked to return, in addition to the checklist, the name of a person or two who they considered should be included in a study involving influential professional leaders in American physical education.

The returns from this supplementary selection provided 86 different names, 51 of which were "new" names. However, only those persons receiving mention from two or more of the initial 35 were used as respondents in the investigation. This accounted for the selection of 17 additional individuals and extended the list of influential leaders to a total of 52.

Tabulation of the data. Of the 52 checklists distributed to leaders in American physical education, 49 were returned. The process of tabulating the returns included the tallying of the responses according to philosophical positions and the intensity of the belief as indicated by the respondent. The total response was then tabulated to determine the extent of eclecticism and the relationship of philosophical positions to factors of belief intensity, age, sex, and geographical distribution.

Analysis and interpretation of the data. Following the tabulation of the data, interpretations of the responses were made within each category in the checklist. The checklist responses, having been tabulated and interpreted, were then analyzed and grouped, on the basis of common elements, into what seemed to indicate two basic educational philosophies—Naturalism and Spiritualism.

Naturalistic philosophy includes Realism and Pragmatism and holds that the universe requires no supernatural explanation. According to Naturalism, the universe is self-directing and constitutes the whole of reality. Spiritualistic philosophy, on the the other hand, is a general doctrine which includes Idealism and Aritomism and holds that ultimate reality in the universe is

Spirit. The one major position, Naturalism, stems from a view of nature as dynamic and characterized by change. The other major position, Spiritualism, emerges from the view of a changeless universe comprised of primarily stable factors which stem from a supernatural source. The first mentioned major position views human nature as more materialistic and regards values as never more than relatively constant. Such a position can be seen as a continuation of the more general naturalistic concept of the universe. The spiritualistic position continues with a view of man as a spiritual being and considers values as absolute and enduring.

Findings

It was in the area of "program building" that leaders in American physical education indicated the greatest unanimity of belief. On the basis of the naturalistic response in this area, it seems reasonable to expect that professional leaders are emphasizing the scientific bases for programs of physical education. It is likely, too, that programs of physical education are reflecting national, cultural, and economic changes in an attempt to equip students with physical-recreational skills to meet the problems of life.

TABLE 1

Percentage of Responses Showing Extent of Naturalistic and Spiritualistic Beliefs According to Categories in the Checklist

Categories of the Checklist	Percentage of Naturalistic Responses	Percentage of Spiritualistic Responses
The Universe	76	24
Man	64	36
Values	73	27
Education	54	46
Program Building	89	11
Program Content	75	25
The Administrator	42	58
The Teacher	65	35
The Learner	60	40
Learning	69	31
Teaching Methods	73	27
Evaluation	56	44

In three of the checklist areas—Evaluation, The Administrator, and Education, the majority of naturalistic or spiritualistic beliefs was less than 60 per cent. There appeared, therefore, to be evidences of a dual influence in these three areas.

The extent of eclecticism. Among the most striking characteristics of the total tabulated responses was the extent of eclecticism indicated by the respondents. Generally defined as "the practice of choosing beliefs from various or diverse systems of thought," eclecticism, as used in the present study refers to the extent which respondents checked beliefs from various philosophical positions.

In order to more sharply determine the consistency of naturalistic or spiritualistic responses on an individual respondent basis an interpretation of the data for this eclectic factor was limited to those 39 respondents who checked one belief in all 12 of the checklist categories. Since an accurate tabulation for this particular interpretation could be made only on the basis of the same number of responses by each individual, the ten respondents who checked more than one statement within a single category, or failed to check a statement in one or more of the categories, were not included.

Twenty-one respondents, 54 per cent of those who completed the checklist according to instructions, indicated naturalistic beliefs in at least two-thirds of the checklist categories. Five respondents (13%) indicated spiritualistic beliefs in at least two-thirds of the checklist categories. Thirteen respondents (33%) were eclectic to the extent that they indicated naturalistic or spiritualistic beliefs in seven, and the alternate position in five categories. According to the accepted view of eclecticism, 13 respondents appeared to hold essentially eclectic beliefs.

The responses to the checklist indicated that, when considered individually, about twice as many of the respondents appeared to hold essentially naturalistic beliefs as either spiritualistic or eclectic. However, those who held an essentially spiritualistic view indicated somewhat more strongly-held beliefs.

The factor of "advanced maturity." Seven of the 49 respondents who participated in the study were either in or approaching retirement. This did not constitute a sufficient number from which to draw a conclusion. However, considered from the standpoint of two major philosophies, there was virtually no difference between the responses of this group and others participating in the study.

The geographical factor. The checklist responses indicated a predominance of naturalistic beliefs checked by the respondents from all four sections of the United States—eastern, central, southern, and western. The largest percentage of checklist responses identifiable with naturalistic philosophy (68%) was checked by respondents from the West, and the largest percentage of spiritualistic responses to statements in the checklist (45%) was indicated by respondents from the South.

The sex factor.—A tabulation of responses with respect to the sex of the respondent revealed no significant difference from that of the total group. The male respondents, however, indicated a majority of moderately-held beliefs, whereas the female respondents indicated a majority of strongly-held beliefs.

Conclusion

On the basis of present indicated beliefs, it was concluded that most professional leaders appear to be providing a predominantly naturalistic direction to American physical education. The study revealed some evidences of strong spiritualistic beliefs which suggested a dual influence and lack of general agreement in some areas of physical education.

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(Submitted 1/14/57)

Ten-Year Survey of Physical Fitness Tests at Yale University

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Abstract

This study is a survey of the achievement of freshman students at Yale University on six tests of Physical Fitness which are administered as part of the regular program of physical education. The data covers a period of ten years, from 1947 to 1956, during which time approximately 10,000 undergraduates were tested. The tests used were: pull ups, push ups, fence vault, sit ups, standing broad jump, and vertical jump.

WHEN YALE University returned to its more normal enrollment after the war, it was felt that certain tests in physical fitness should become a definite part of the freshman required program of physical education. The tests to be used and the standards to be expected, however, had to be determined.

During the years 1942 to 1945, when the various Service units were stationed at the University, physical fitness tests were administered to all Army, Navy, and Air Force trainees, as part of their conditioning program. Scores of these tests were available on over 3,000 men, and it was decided to use the approximate average score achieved by these men at the start of their training period as the standard for passing the freshman test.

There were a number of fitness tests used for the Service groups and it did not seem feasible to administer all of them, because of the length of time it would take. For two years, immediately after the war, some of the different tests were used as part of the freshman program and by the time the Class of 1951, which entered as freshmen in September 1947, started on the required program in physical education, definite tests and definite minimum standards had been established.

The items finally selected to compose the battery of physical fitness tests for freshmen were chosen for two principal reasons. In the first place, a test item was selected only if it could be administered accurately and without the need of excess equipment. Secondly, items were selected only if they aided in revealing the over-all strength of definite parts of the body. The six items making up the test, together with the level of achievement required for passing, were as follows:

A. To indicate the strength of the upper-arms

1. Pull Ups (standard eight times)—The ordinary grasp (palms forward) was used on the horizontal bar, and the body pulled up until the chin was even with or above the bar. The arms then came down to a complete extension before the next chin was started. No swaying of the body was allowed.

2. Push Ups (standard 25 times)—The starting position for the push up test was (lying prone) on the floor, with the hands placed directly under the chest and about shoulder width apart. The body was then pushed up from the floor by extension of the arms and returned to a position so that the chest was just above the floor. No sagging or humping of the body was permitted.

B. To indicate abdominal and hip flexor strength

3. Trunk Raising (standard 50 sit ups)—The starting position was lying supine on the floor with the hands clasped behind the neck. The feet were held stationary, either by having them held down to the floor by another person or by anchoring them under the lowest or next to the lowest stall bar. Each time the trunk was raised to an erect position, the elbow touched the opposite knee, alternating on each sit up.

C. To indicate body agility and co-ordination

4. Fence Vault (standard 4 ft. 6 in.)—The bar was set at a height of four feet and six inches. The vault was executed by gripping the bar with both hands and vaulting over without touching either legs or hips to the bar. The landing was made in an upright position with back to the bar. Five or six trials were allowed if desired.

D. To indicate leg strength and muscular explosiveness

5. Standing Broad Jump (standard 86 in.)—The jump was executed on a mat which was marked off with a take-off line and with lines at two-inch intervals beginning 48 inches from the take-off mark and extending along the mat until a distance of 108 in. could be easily measured. Three trials were allowed, with the best of the three recorded.

6. Vertical Jump (standard 18 inches)—In performing the vertical jump, the individual was instructed to stand with toes against and facing the measuring board. He was then told to reach and touch a point on the board as high as possible without straining. The jump up was made as in the basketball center jump, with the individual touching the board at the highest possible point. The distance between his standing reach and jumping touch was then measured.

(*Note:* The Harvard Step Test (Brouha Test), an excellent measure of endurance, was administered during the early years of the testing. However, it was later discontinued because of the large number of entering freshmen and consequently longer time which was necessary to give the test.)

Nearly 10,000 freshman students have taken these tests, starting with the Class of 1951, which entered in September 1947, and carrying through to the Class of 1960, beginning in the fall of 1956. Results of each of these classes, shown in Table 1, indicate that a fairly large percentage of the group met the minimum standard in each individaul test item. In fact, over 90 per cent of the 10,000 freshmen could jump 18 inches or better in the vertical jump, while better than 70 per cent could meet the minimum requirements in each of the broad jump, push up, sit up, and fence vault tests. The pull-up test showed the greatest number of failures, in that a little over 40 per cent of the 10,000 entering freshmen failed to meet the standard of eight chins. When all six tests were considered together, however, the picture was quite different, as indicated in Table 2. Only 29 per cent of the Class of 1953 met the standards in all tests, while 51 per cent of the Class of 1951 passed the requirements. Other entering classes ranged between these two figures.

The program of physical education for freshmen at the University has three basic requirements. First, the student must be able to swim a distance of 100 yards. If he fails to do this, he is assigned to classes in beginning swimming until this requirement is met. The second requirement is in posture, and certain minimum standards established by the Department of

TABLE 1
Results of Initial Fitness Tests for Classes 1951-60
(Six individual test items)

Test Item	Number of Cases	Number and Per Cent Passed	Number and Per Cent Failed	Average	Range
Broad Jump	10,881	7,630—76%	2,451—24%	86.3 inches	36-117 inches
Vertical Jump	10,119	9,230—91%	889— 9%	19.2 inches	7- 30 inches
Push Ups	10,078	7,660—76%	2,418—24%	23.3 times	0- 80
Fence Vault	10,036	7,238—72%	2,798—28%	----	------
Sit Ups	10,095	7,538—75%	2,557—25%	47.0 times	0-150
Chins	10,085	5,975—59%	4,110—41%	6.9 times	0- 21

TABLE 2
Results of Initial Fitness Tests for Classes 1951-60
(Using entire battery of six tests as one unit)

Class	Number Tested	Number and Per Cent Passed	Number and Per Cent Failed
1960	972	369—38%	603—62%
1959	962	357—37%	605—63%
1958	940	374—40%	566—60%
1957	946	423—45%	523—55%
1956	962	414—43%	548—57%
1955	1,114	483—43%	631—57%
1954	969	385—40%	584—60%
1953	1,011	292—29%	719—71%
1952	1,117	512—46%	605—54%
1951	1,026	519—51%	507—49%
1951-60	10,019	4,128—41%	5,891—59%

Physical Education must be attained. Failure to achieve these standards on the initial test necessitates assignment into one of the "corrective classes." The third requirement is in physical fitness, and students failing one or more of the fitness tests are assigned to a "fitness class."

In these classes particular stress is placed upon helping the individual to develop strength in the areas in which he shows weakness as a result of his test score. The men who passed the requirements in swimming and posture at the beginning of the year were assigned immediately into a "fitness class" if they had failed one or more of the fitness tests. The men in this group, called Fitness Group I, showed remarkable improvement in physical development as a result of concentrated effort (12 to 14 weeks with three half-hours per week) on their specific weaknesses, as it is indicated in Table 3. Of the 642 men during the period who failed the broad jump and were retested

TABLE 3
Results of Fitness Group I for Classes 1951-60

Test Item	Number of Cases	Number and Per Cent Passed	Number and Per Cent Failed	Average	Range
Broad Jump					
1st test	642	—	—	78.2 in.	50-85 in.
2nd test	642	544—85%	98—15%	86.7 in.	59-100 in.
Vertical Jump					
1st test	194	—	—	15.9 in.	12-17 in.
2nd test	194	176—91%	18— 9%	18.1 in.	14-25 in.
Push Ups					
1st test	628	—	—	16.6 times	0-24 times
2nd test	628	517—82%	111—18%	23.7 times	3-21 times
Fence Vault					
1st test	724	—	—		
2nd test	724	637—88%	87—12%	—	—
Sit Ups					
1st test	695	—	—	33.2 times	8-49 times
2nd test	695	659—95%	36— 5%	49.6 times	20-67 times
Chins					
1st test	1,162	—	—	4.5 times	0-7 times
2nd test	1,162	828—71%	334—29%	7.1 times	0-11 times

after specific work on the jump, 85 per cent passed. Ninety-one per cent passed the vertical jump, 82 per cent the push ups, 88 per cent the fence vault, 95 per cent the sit ups, and 71 per cent the pull ups.

Table 4 shows the results of members of all the classes who failed on the initial test and were retested. Some of the students, as mentioned before, were assigned directly to classes in physical fitness. These men stressed work on the weaknesses which were indicated as a result of the test scores. Others, who had failed the swimming and/or posture tests in the beginning were not assigned to the fitness classes until after they had passed those tests. During their classes in swimming and posture, however, the men were exercising regularly three times a week, so showed a great deal of improvement in the fitness test scores. In the broad jump, for instance, 2,111 men failed, and 76 per cent passed when they were retested. Seven hundred and thirty-seven failed the vertical jump in the beginning, with 84 per cent passing by the end of the period. The other tests showed 2,115 failing the push ups, with 71 per cent passing; 2,126 the fence vault, with 83 per cent passing; 2,222 the sit ups, with 92 per cent passing; and 3,580 the pull ups, with 57 per cent passing.

By the end of the required period of physical education (as shown in Table 5) 9,660 men were tested, with 80 per cent passing all tests and 20 per cent failing one or more tests. A comparison of Table 5 with Table 2 shows that whereas only 41 per cent passed the six fitness tests at the beginning of the year, almost 80 per cent passed after 12 to 14 weeks of three half-hour periods of exercise per week.

TABLE 4
Results of All Men Who Failed Initial Test for Classes 1951-60 and Were Retested

Test Items	Number of Cases	Number and Per Cent Passed	Number and Per Cent Failed	Average	Range
Broad Jump					
1st test	2,111	—	—	77.6 in.	36-85 in.
2nd test	2,111	1,609—76%	502—24%	84.8 in.	50-100 in.
Vertical Jump					
1st test	737	—	—	15.7 in.	10-17 in.
2nd test	737	616—84%	121—16%	17.8 in.	12-25 in.
Push Ups					
1st test	2,115	—	—	16.1 times	0-24 times
2nd test	2,115	1,491—71%	624—29%	22.2 times	0-38 times
Fence Vault					
1st test	2,126	—	—	—	—
2nd test	2,126	1,775—83%	351—17%	—	—
Sit Ups					
1st test	2,222	—	—	33.5 times	0-49 times
2nd test	2,222	2,043—92%	179— 8%	49.0 times	8-75 times
Chins					
1st test	3,580	—	—	4.3 times	0-7 times
2nd test	3,580	2,055—57%	1,525—43%	6.4 times	0-18 times

TABLE 5
Results of Fitness Retests for Classes 1951-60
(Using all six tests as a single unit)

Year	Number Tested	Number and Per Cent Passed	Number and Per Cent Failed
1960	977	771—79%	206—21%
1959	940	779—83%	161—17%
1958	967	741—77%	226—23%
1957	979	807—83%	172—17%
1956	952	774—81%	178—19%
1955	1,107	876—79%	231—21%
1954	925	791—73%	134—27%
1953	994	804—80%	190—20%
1952	1,011	839—83%	172—17%
1951	808	513—63%	295—37%
1951-60	9,660	7,695—80%	1,965—20%

Close analysis of the results of these tests over a period of years points to three very definite factors. In the first place, the individuals taking the tests consistently performed better in those items which were to some degree a measure of leg power, such as the vertical jump and broad jump. The fact that practically all activities, sports, and games in which youngsters participate emphasize the use of the legs in running and jumping is without doubt the reason for better performance in tests of this nature.

Secondly, retest results, as pointed out in Table 4, indicate that a skill requiring agility and body control, such as the fence vault, seems to be quickly learned in comparison to the amount of time it takes an individual to increase the strength of various muscular groups. For instance, over 83 per cent of the individuals who failed to execute the fence vault in the initial test passed the test at sometime within the 12 weeks of three half-hour periods per week. Most of the men, in fact, passed the test after only two or three hours of practice. In the pull-up test, however, only 59 per cent passed within the 12 weeks of practice, and in this case the full amount of practice time was needed by the majority of men.

In the third place, the strength of the abdominal muscles, which is indicated to some extent by the ability to perform sit ups seems to be developed much more quickly than the strength of the arm flexors and extensors. At any rate 92 per cent of the individuals failing to do 50 sit ups at the initial test passed the test during the 12-week period, whereas only 50 per cent of those failing to do eight chins passed in the same amount of time. One factor which must be considered, however, is that in the pull ups the arm flexor muscles must lift the entire body weight, but the abdominal and hip flexor muscles are not required to handle so great a resistance in performing the sit ups. Another factor is that it may be easier for many individuals to do 50 sit ups than it is to do eight chins.

A final observation of these data clearly indicate that an individual's strength, agility, and co-ordination can be improved in a rather short period of time where concentrated effort is placed upon that particular factor, and the exercises are at regular intervals. This is revealed by the fact that nearly 80 per cent of the individuals who failed one or more tests in the initial testing period were able to pass the six tests during the 12-week program of three half-hour periods per week.

(Submitted 5/1/57)

Lateral Dominance in the Teaching of Bowling

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Abstract

A screening test for lateral dominance was administered to 167 college women. Twenty-six showed left dominance. Of this group four were taught to bowl left-handed, six were eliminated from the study for various reasons and 16 were taught to use their preferred hand, the right. All 20 subjects preferred using their right hand. Both groups were equated as to the amount of practice and motor ability. The group using the presumably dominant left hand were significantly poorer in their bowling average than the group which, though demonstrating left dominance, were permitted to bowl with their preferred hand.

SEVERAL YEARS ago, this author's interest in dominance and laterality was stimulated by an article appearing in a British publication (8). The article suggested that in place of two classes of people, right- and left-handed, there were, in reality, five. To the above two classes were added the left-handed person who has been compelled to use the right hand, the truly ambidextrous, and the ambisinistral or one who has no natural preference. The author suggested the need for research in this area, including the establishment of practical tests to determine dominance. The article expressed concern for children who were not dominantly right- or left-handed, and it was suggested this might be linked with school failure.

While the British publication was primarily interested in dominance in relation to intellectual activities, it seems that it might be even more important to motor activities.

The purpose of this study was to discover whether an individual should be encouraged to learn a motor skill with what appears to be the dominant hand or to use the preferred hand. Dominant hand was determined by test. Preferred hand is defined as that hand which the individual considered dominant. The motor skill involved was beginning bowling.

Review of Literature

Hildreth (5) has suggested the following criteria for tests appraising handedness and other aspects of lateral dominance. The testing should include (a) practiced and unpracticed or random acts, (b) trained and untrained hand usages, (c) single-handed and bimanual performance, and (d) activities requiring both finer and coarser motor co-ordinations. She suggested as possibilities such acts as ball play (throwing, rolling, catching), drawing lines, cutting, hammering, scratching matches, unwrapping, winding thread, thread-

ing a needle, buttoning, and many more. In assessing hand dominance, she suggests using the formula $\frac{R - L}{R + L}$. The acts were checked as to which hand dominated. The total number of tasks in which the right hand was dominant was entered in place of R. The number of tasks where the left hand was dominant was substituted for L. A negative score indicated left dominance.

Selzer (10) had suggested some of the same tasks in an earlier publication. One additional test he mentioned was the use of the hand dynamometer. Selzer also listed tasks for determining foot and eye dominance.

Burge (2) advocated measuring three types of hand functions to determine dominance: strength, speed, and accuracy. Strength was measured by a hand dynamometer, speed by ball bouncing, and accuracy by target throwing. He concluded among other things that there was little or no relation between the three functions of speed, accuracy, and strength. He also stated that the accuracy test was superior to strength and speed for diagnostic purposes.

Procedure

In a previous study by Fox and Young (4), a battery of 29 tests was set up to measure hand, eye, and foot dominance. Some of these tests were suggested by Selzer and Hildreth and other original tasks were added. For ease of administration to a large number as a screening battery, the battery used by Fox and Young was shortened to five tests for this study. Hand dominance only was considered, as it was found in the Fox and Young study that hand-eye-foot dominance was not identical in many subjects.

The first two tests involved reaching for a folder of matches and then breaking one off and striking it. It was noted which hand the subject used in reaching for the match folder and which hand she used for striking the match. The hand used was considered the dominant hand for these tests. These two tasks are essentially self-taught skills and therefore not as apt to be subject to coaching from parents. The third task was needle-threading. A large-eyed needle was used. It was noted which hand was used either to push the thread through the needle eye or with which the needle was guided onto the thread. The hand doing the moving was considered the dominant hand in this test.

The fourth test was a timed peg-placing test. A small board into which nine pegs might be placed was used. The subject was timed using first one hand and then the other to place the pegs in the holes. She could use her preferred hand first. The hand taking the least time to complete the task was considered the dominant one.

The last test was a grip strength test using a hand dynamometer. The stronger hand was considered dominant. A dominance index was computed for each subject, using the formula suggested by Hildreth. Because of the

limited number of tests, a true continuum does not result from using the formula; however, the scores do vary from more dominant right through ambisinistral to more dominant left. For purposes of this study the subjects were dichotomized into right- and left-dominance groups.

The subjects were college women at the State University of Iowa, registered in beginning bowling classes. The classes met twice a week for 15 lessons. Each lesson was 90 minutes in length. Of the 172 women registered in bowling classes, five did not complete the five-test battery. Of the 167 subjects completed, 26 demonstrated a left dominance. Of this number records were incomplete on one case, one subject dropped out of school, and three definitely considered themselves left-handed and thus were dropped from the experiment. One bowler in the left-dominance group was past the beginning stage so she also was dropped from the experiment. Of the remaining 20 subjects, only four could be persuaded to use their apparently dominant hand, the left hand rather than their preferred hand which was the right hand. The subjects who learned left-handed will be referred to as the control group while those who bowled right-handed will be considered the experimental group.

The number of games on which scores were kept varied. The range and the mean number of games bowled for the two groups are to be found in Table 1. Although there is a difference between the mean for the experimental and control groups, the t-test is not significant and it can be assumed that there was no real difference in the amount of practice between the two groups.

TABLE 1
Comparison of Twenty Left-Dominant Cases Studied

Group	N	Range	Mean	t
Number of Games Bowled				
Experimental	4	9-13	11.50	1.56
Control	16	5-13	7.88	
General Motor Ability T Scores				
Experimental	4	45-61	55.25	0.26
Control	16	42-75	56.38	
Bowling Averages				
Experimental	4	79.73-96.08	86.30	3.27
Control	16	80.11-121.33	98.26	

NOTE: df = 18
1% level of confidence 2.878

On entrance to the university, every woman is given the Scott General Motor Ability Test (9). The mean scores for the two groups were compared to see if there was any difference in experience between the two groups (Table 1). The t-test was insignificant, which indicates that on motor ability the groups can be assumed to be equated.

When the mean scores of the bowling averages were compared (Table 1), it was found that there was a significant difference in favor of the group which used their right hand to bowl even though they showed a left dominance.

It was observed earlier in giving the long battery that the strength and dexterity tests were probably more indicative of hand dominance than a test of reaching for some object as there is an element of chance in which hand was extended for the object. In re-examining the scores of the four subjects who used their left hand to bowl, three of the four showed definite left-handed scores in both the dexterity and strength test, while the fourth was dominant in dexterity but not in strength (Table 2).

TABLE 2
Dominance on Strength and Dexterity Tests of Dominance

Group	N	Strength L	Strength R	Dexterity L	Dexterity R
Experimental	4	3	1	4	0
Control	16	10	5*	8	8

*One subject had identical strength scores for right and left hands.

Of the 16 control subjects, only four were left-dominant in both tests, two were right-dominant in dexterity and strength but left-dominant in reaching, needle-threading, and match-striking tests. One subject showed equal strength scores but left dominance in dexterity. The remaining nine showed mixed dominance in dexterity and strength but enough over-all left dominance to give a left-dominance index. Therefore, it seemed reasonable to assume that if it is desirable to teach a left-dominant individual to bowl left-handed, even though she prefers to use her right hand, there was an optimum opportunity in this experiment for it to succeed.

Summary and Conclusions

Of 172 subjects tested for hand dominance, 26 demonstrated a definite left-handed index. Although all 20 preferred using their right hand, four were taught to bowl using their left hand, while 16 were taught to use their right hand. Differences between the two groups in motor ability and number of games bowled were insignificant. Although the experimental group showed stronger left-handed dexterity and strength than the control group, their bowling averages were significantly inferior.

There are two factors to be considered in evaluating the results. First, the experimental group was very small. While the difference which was found in bowling averages was statistically significant, it might be of interest to repeat the experiment with a larger experimental group. Another factor to be considered was that bowling involves more than the use of the arms. Therefore, hand dominance may be only one of the factors to be considered in choosing which side to use. It is quite possible that the long-established coordinations of hand, eye, and foot are more important than hand dominance. It would appear that the preferred hand rather than the dominant hand should be used as the bowling hand.

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Apparatus Gymnastics Knowledge Test for College Men in Professional Physical Education[1]

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Abstract

The purpose of this study was to develop and standardize a knowledge test of apparatus gymnastics for college men in professional physical education. An experimental test was administered to 586 college men in professional physical education at 21 colleges and universities. Item analysis data obtained from this administration resulted in the production of a revised test of 100 valid items. The final test was taken by 940 college men in professional physical education enrolled in 40 colleges and universities representing various sections of the United States. National norms were established as a result of this final administration.

KNOWLEDGE OF apparatus gymnastics is an important objective in the education of college students preparing to teach physical education. Up to this time there has existed no standardized instrument for measuring such knowledge. The development of such a test would help to satisfy an important need in this area as well as in the general field of testing in physical education.

Purpose

It was the purpose of this study to develop and standardize a knowledge test of apparatus gymnastics for college men in professional physical education.

Procedure

In order to obtain material for inclusion in the test items, a review of the literature dealing with gymnastics was made. Textbooks, courses of study, and periodical literature dealing with gymnastics were consulted. Items of information thus gleaned were noted on filing cards and classified according to the topic discussed.

A topical outline was made from the information on the file cards with a view to obtaining major objectives of the acquisition of knowledge in apparatus gymnastics. From this outline was developed a checklist of commonly accepted content listed as objectives.

To provide test content including only significant subject matter in appropriate amounts by major objectives, the checklist was submitted to a jury of

[1]This investigation was conducted under the direction of Dr. Karl W. Bookwalter, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Physical Education, 1954.

educators for their estimates of the contribution of the subject matter to a course in apparatus gymnastics.

Criteria employed in the selection of judges included the following:

1. Persons whose contributions to the field of physical education and to gymnastics especially indicate the possession of sound judgment.
2. Persons who have conducted successful gymnastic programs.
3. Persons who have demonstrated interest and devotion to gymnastics as a worthwhile facet of a youth's education and life.

Fifteen judges responded to the checklist, indicating whether each individual item was Significant, Acceptable, or Not Acceptable. The results were summarized and a Table of Specifications was formed. The percentages of emphasis recorded in Table 1 indicate the relative importance of the objectives in determining the number of test items in each area on the experimental and final tests.

TABLE 1

Table of Specifications for the Purpose of Determining the Number of Test Items in Each Area on the Experimental and Final Tests

Major Areas (Objectives)	Percentage of Emphasis
1. Activities	30
2. Competitions and exhibitions	8
3. Health, safety, hygiene	11
4. History	4
5. Mechanical principles, coaching hints, form, etc.	17
6. Nomenclature	10
7. Relation to general education, values, etc.	6
8. Selection and care of equipment	6
9. The promotion of learning, motivation, etc.	8
Total	100

In order to compute the average intercorrelation of the estimates of the 15 judges, a simple method suggested by Peters and Van Voorhis was used (9, *pp. 196-201*). This average intercorrelation was found to be +.528, representing the agreement between the judges on the sums of the checklist ratings. This procedure was used previously in physical education testing by Phillips (10), Miller (8), and Langston (6).

To aid in the construction and selection of the test items, the original card file of subject matter content was consulted and the cards were rearranged according to the major objectives decided upon in the Table of Specifications. From these informational items were constructed the test questions which were tried in pilot studies with students and instructors in the Los Angeles area; State Colleges at Superior and La Crosse in Wisconsin; Indiana University; and the State University, Tallahassee, Florida. Revisions were made as a result of these trials and the experimental test was formed to correspond with the Table of Specifications.

The experimental test consisted of 150 items: 90 true-false, and 60 multiple-choice. The items were arranged in the test in order of difficulty within the true-false and multiple-choice sections by areas or objectives, in effect producing a "cyclic order of difficulty" (12).

Test directions were formulated and duplicated.

A letter was drafted enlisting the aid of instructors and institutions in administering the experimental test to students in their apparatus gymnastics classes. This letter was sent to institutions listed as providing professional education in health, physical education, and recreation. (2). Reply cards returned were set in a file to be used in sending tests at the times requested.

Upon receipt of the answer sheets from a participating school, they were hand-scored for the number correct, and the results were forwarded immediately to the instructor.

Twenty-one colleges and universities submitted a total of 586 experimental test answer sheets which were completed by college men in professional physical education. University students numbered 270 and college students numbered 316.

An extensive analysis was made of the results of the experimental test in order to determine the content of the revised test.

The revised test consisting of 100 valid items was taken by 940 college men in professional physical education enrolled in 40 colleges and universities representing various sections of the country.

The test answer sheets were arranged according to the number of class hours of instruction in apparatus gymnastics. It was found that instruction varied from 8 hours to 192 hours, with the average being 40.8 hours.

Differences of opinion exist relative to the matter of whether or not to correct for chance success the raw scores obtained on objective examinations (5). The directions to the student taking the apparatus gymnastics knowledge test were to "respond to every item." Therefore, the results of analyzing raw scores without correction formed the basis of this study. As a side issue, however, it was decided to correct the true-false section for chance success (rights minus wrongs) and assign new scores to each answer sheet in some attempt to clarify the issues.

While the procedure of scoring papers two different ways after issuing only one set of directions to the student may involve some serious objection, nevertheless, it may serve to stimulate further study in this direction (1).

To prepare for the analysis of the test items, the upper 27 per cent and the lower 27 per cent of the test answer sheets were removed from the total number of papers which were originally arranged in order of total raw scores uncorrected. The same procedure was followed using the arrangement on the basis of corrected scores.

Item count data for the test items were obtained by processing on the IBM test scoring machine with graphic item counter attachment.

The resultant item counts were entered on tabulation sheets. The proportion of each group answering each item correctly was computed and entered on the tabulation sheets.

The proportion of the upper group passing the item and the proportion of the lower group passing the items were used to enter the Flanagan Tables to determine the index of discrimination for each item (3). This index was noted for each item on the tabulation sheets. All items having an index of .20 or higher were considered acceptable, valid items for the test (11).

Phillips (10), Langston (6), and Miller (8) found the Votaw Curve (13) an effective and simple method of determining valid test items. The Votaw procedure was also used on this test to aid in the selection of test items.

The difficulty rating of each item was determined by dividing the number of correct responses to that item by the number of test papers. Items too difficult or too easy were eliminated.

These evaluative procedures guided the selection of suitable items for inclusion in the revised test.

Administration of the revised test provided the bases for the establishment of national norms in four categories: Entire Group, Beginners, Intermediate, and Advanced.

Statistical Analysis

Statistical analysis of the raw scores on the experimental test revealed the following: the mean was 81.45; the median, 81.45; the standard deviation, 10.90; and the reliability coefficient as determined by the Froelich adaptation of the Kuder-Richardson formula was .69 (4). When the true-false section was corrected for chance success, the following results were obtained: the mean was 48.04; the median, 47.81; and the standard deviation was 16.14. This procedure raised the reliability coefficient to .88.

With regard to the selection of valid items for the corrected group and for the uncorrected group using both the Flanagan and the Votaw methods, there were 75 agreements; that is, 75 items proved valid on both Flanagan and Votaw procedures, and they were the same items for both groups.

In the same manner, there were 75 agreements when the Flanagan Index alone was used for both groups. When the Votaw Curve alone was used for both groups, the two groups agreed on the validity of 104 items.

For the uncorrected group, three items which were valid by the Votaw technique did not prove valid for the corrected group. For the corrected group, ten items valid by the Votaw Curve did not prove valid for the uncorrected groups. All of these items were true-false items.

Each group obtained eight valid questions not obtained by the other group using the Flanagan Index. The uncorrected group had five multiple-choice questions chosen by the Flanagan Index which did not prove valid for the corrected group. All other questions involved were true-false questions. By the Flanagan Index, the uncorrected group had a total of 82 items proving valid. The corrected group also had 82 valid items according to the same index.

The uncorrected group had 109 items proving valid on the Votaw Curve, while the corrected group had 115.

All items which were valid by the Flanagan Index were also valid according to the Votaw Curve. The Votaw curve seemed more lenient in determining item validity than did the Flanagan Index when used with this test.

A comparison of the difficulty ratings of the items revealed a range of 1 per cent to 96 per cent, with an average of 53.59 per cent for the uncorrected group, and a range of 1 per cent to 96 per cent, with an average of 53.61 per cent, for the corrected group.

Therefore, little seems to be gained with respect to item-analysis when a correction formula is used. Whatever differences exist are small and of apparently little consequence. Again, it must be cautioned that these data result from two methods of scoring, but from papers responding only to one set of directions.

Of the valid items determined through use of both procedures, the Flanagan and the Votaw, 111 were considered acceptable for use on the apparatus gymnastics test. Since 100 items make a convenient and workable test for administration during one class period of 45 to 60 minutes duration, it was decided to eliminate 11 items. The proportions in the Table of Specifications and the difficulty ratings helped to determine which 11 items to eliminate.

The final test consisted of 45 true-false items and 55 multiple-choice items.

The average difficulty of the items on the final test was 51.62 per cent, with a range of 8 per cent to 91 per cent. The average difficulty of the true-false section was 63.04 per cent and for the multiple-choice section, 42.64 per cent.

Administration of the final test yielded the following statistics: the mean was 56.35; the median, 56.05; and the standard deviation for the grouped frequency distribution of the raw scores was 9.40. Reliability as determined by the Froelich adaptation of the Kuder-Richardson formula was .72. The raw scores were not corrected for chance success. The scores ranged from a low of 21 to a high of 88.

It was found that three groups could be formed on the basis of the number of hours of instruction in apparatus gymnastics. A group having 8 to 30 hours instruction was called the Beginning Group. The Intermediate Group had 32 to 60 hours instruction. The Advanced Group had 64 to 192 hours instruction. An examination of the results in Table 2 will reveal the extent and significance of the obtained differences between the Beginning and Intermediate groups and between the Intermediate and Advanced groups. It may be concluded that differences as large as those found seem too great to be attributed to chance alone. Since the significance ratios exceed three, they indicate a very high degree of confidence that the null hypothesis may be declared false (7).

National Norms

In order to assist test users to arrive at meaningful interpretations regarding raw scores obtained by individuals taking the test, t-scales for the three groups and for the entire group have been formulated (Table 3). These scales were determined after the method suggested by Lindquist (7).

TABLE 2

Comparisons of Beginning, Intermediate, and Advanced Groups on the Final Test

Statistic	Beginning		Intermediate		Advanced
Number	287		539		114
Mean	52.10		57.20		62.65
Standard error of mean	.52		.38		.87
Standard deviation	8.75		8.70		9.30
Sampling error		5.10		5.45	
Standard error of the difference between means		.94		1.17	
Significance ratio		5.40		4.87	

TABLE 3

T Scales for Beginning, Intermediate, Advanced, and Entire Groups

Raw Score	T-score Beginning Group	T-score Intermediate Group	T-score Advanced Group	T-score Entire Group	Raw Score
100	100	99	90	96	100
99	100	98	89	95	99
98	100	97	88	94	98
97	100	96	87	93	97
96	100	95	86	92	96
95	99	93	85	91	95
94	98	92	84	90	94
93	96	91	83	89	93
92	95	90	82	88	92
91	94	89	80	87	91
90	93	88	79	86	90
89	92	87	78	85	89
88	91	85	77	84	88
87	90	84	76	83	87
86	89	83	75	82	86
85	87	82	74	80	85
84	86	81	73	79	84
83	85	80	72	78	83
82	84	79	71	77	82
81	83	77	70	76	81
80	82	76	69	75	80
79	81	75	68	74	79
78	79	74	67	73	78
77	78	73	65	72	77
76	77	72	64	71	76
75	76	70	63	70	75
74	75	69	62	69	74
73	74	68	61	68	73
72	73	67	60	67	72
71	71	66	59	66	71

TABLE 3 (*Continued*)

Raw Score	T-score Beginning Group	T-score Intermediate Group	T-score Advanced Group	T-score Entire Group	Raw Score
70	70	65	58	65	70
69	69	64	57	63	69
68	68	62	56	62	68
67	67	61	55	61	67
66	66	60	54	60	66
65	65	59	52	59	65
64	64	58	51	58	64
63	62	57	50	57	63
62	61	55	49	56	62
61	60	54	48	55	61
60	59	53	47	54	60
59	58	52	46	53	59
58	57	51	45	52	58
57	56	50	44	51	57
56	54	49	43	50	56
55	53	48	42	49	55
54	52	46	41	47	54
53	51	45	40	46	53
52	50	44	39	45	52
51	49	43	37	44	51
50	48	42	36	43	50
49	46	41	35	42	49
48	45	39	34	41	48
47	44	38	33	40	47
46	43	37	32	39	46
45	42	36	31	38	45
44	41	35	30	37	44
43	40	34	29	36	43
42	39	33	28	35	42
41	37	31	27	34	41
40	36	30	26	33	40
39	35	29	25	32	39
38	34	28	23	30	38
37	33	27	22	29	37
36	32	26	21	28	36
35	31	24	20	27	35
34	29	23	19	26	34
33	28	22	18	25	33
32	27	21	17	24	32
31	26	20	16	23	31
30	25	19	15	22	30
29	24	18	14	21	29

TABLE 3 (*Continued*)

Raw Score	T-score Beginning Group	T-score Intermediate Group	T-score Advanced Group	T-score Entire Group	Raw Score
28	23	16	13	20	28
27	21	15	12	19	27
26	20	14	11	18	26
25	19	13	10	17	25
24	18	12	8	16	24
23	17	11	7	15	23
22	16	9	6	13	22
21	15	8	5	12	21
20	13	7	4	11	20
19	12	6	3	10	19
18	11	5	2	9	18
17	10	4	1	8	17
16	9	3	0	7	16
15	8	1	0	6	15
14	7	0	0	5	14
13	6	0	0	4	13
12	4	0	0	3	12
11	3	0	0	2	11
10	2	0	0	1	10
9	1	0	0	0	9
8	0	0	0	0	8
7	0	0	0	0	7
6	0	0	0	0	6

Five-point evaluation schedules were formed to provide instructors with guides for possible grading purposes. The schedules were developed using the following formulas:

Excellent: Lower limit—Mean plus 1½ times the Standard Deviation
Superior: Lower limit—Mean plus ½ times the Standard Deviation
Good: Lower limit—Mean minus ½ times the Standard Deviation
Fair: Lower limit—Mean minus 1½ times the Standard Deviation
Poor: All below these values.

Results for the entire group and the three sub-groups are listed in Table 4.

TABLE 4
Five-Point Evaluation Schedules for Beginning, Intermediate, Advanced, and Entire Groups

Rating	Beginning	Intermediate	Advanced	Entire
Excellent	65 and up	70 and up	77 and up	70 and up
Superior	56 — 64	62 — 69	67 — 76	61 — 69
Good	48 — 55	53 — 61	58 — 66	52 — 60
Fair	39 — 47	44 — 52	49 — 57	42 — 51
Poor	Up to 38	Up to 43	Up to 48	Up to 41

Interpretations regarding information gained from consulting these norms and evaluation schedules, however, should not be made without caution. It must be remembered that such scales are derived from analysis of groups which may vary considerably in experience, in amount of instruction, and, possibly, in quality of instruction. An employment of the norms, nevertheless, may give some indication of the student's relative position with respect to knowledge of apparatus gymnastics as compared with a large number of college men in professional physical education enrolled in 40 colleges and universities all over the United States.

Conclusions

The results of this investigation would seem to warrant the following conclusions.

1. A valid, objective, and reliable knowledge test of apparatus gymnastics has been constructed for use with college men in professional physical education. The test can be administered within one class period of 45 to 60 minutes.[2]
2. National norms have been formulated to aid the instructor in assessing the acquisition of knowledge of apparatus gymnastics.
3. The subject matter content of apparatus gymnastics has been organized and evaluated by a competent jury of educators.
4. Two methods of item analysis produced similar results in the selection of items. The Flanagan Index is recommended where ease of operation is desired, since one merely needs to consult tables in evaluating items. The Votaw procedure as used here produced more items, being somewhat more lenient than the Flanagan Procedure. All items on this test proved significant at the 5 per cent level of confidence or better.

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(Submitted 1/4/57)

Relationship of Dynamic Balance to Speed and to Ability in Swimming

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Abstract

High and significant r's were found between dynamic balance (as measured by the Bass Test) and speed in swimming ($-.75 \pm .05$), and dynamic balance and ability in swimming ($.65 \pm .07$). Also, t ratios calculated between these same abilities indicated that dynamic balance is not a chance factor and may be an important factor in speed and in ability in swimming. Further study is needed to determine whether there is a cause and effect relationship between these factors.

WHAT ROLE does dynamic balance play in speed in swimming, and in ability to swim using certain strokes? The ability to maintain one's balance under various circumstances is recognized as one of the basic motor skills. It is an essential factor in movements made in numerous sports and physical education activities. The optimum balance for each sport performance results from the use of the stance best adapted to the particular skills involved in that sport. Hence, balance is an important factor in batting, throwing, and fielding in softball; forehand and backhand drives in tennis; all strokes in golf; line play in football; dribbling and shooting in basketball; building pyramids in gymnastics; etc.

One realizes that the major problems in learning the mechanics of swimming are the minimizing of resistance and the advantageous application of force. Much information on resistance was gleaned from the study of propulsion of ships through the water. Karpovich (6, 7) and others (1, 3) have conducted studies on the various factors which cause loss of force in swimming. Some of these factors are: wave-making caused largely by up and down movements; eddies or swirls caused by merely moving water or changing the stroke; skin friction caused by rough skin, hair, or swim suits; cavitation caused by forcing the body through the water so fast that a cavity is formed; force used at unproductive angles; lack of smooth progress caused by uneven strokes; internal resistance in the body caused by tension; and resistance of the subject's body caused by the shape of the body (2).

McCloy and Young (9, *pp. 5-11*) listed 19 factors in motor educability. One of the factors listed was balance; also, another factor labeled general-kinesthetic sensitivity and control was closely related to balance. This general-kinesthetic sensitivity and control factor is involved in the ability of a performer to sense, by means of proprioceptors in muscles and joints,

positions of the body and of various parts of the body, and to control allied movements with accuracy. If balance is a factor in motor educability, and if balance is so important in the performance-skills of many activities, is it possible that dynamic balance has some correlation with speed in swimming and with ability to swim using certain strokes?

Purpose of the Study

This study was undertaken to determine whether ability in dynamic balance is related to speed and to ability in swimming.

Review of Related Literature

Espenschade (4) stated that dynamic balance is a part of motor co-ordination in certain events. Espenschade, Dable, and Schoendube (5) found that: "Dynamic balance is not related to height or weight but correlates substantially with physical abilities important in the physical education program." Lafuze (8) wrote that students who score in the lower quartile group on the Scott Motor Ability Battery make scores significantly lower than those in the upper quartile group on a test of balance. Mumby (10) stated that: "In balance, and in ability to learn to balance, good wrestlers are somewhat better than poor wrestlers. However, individual differences in these abilities are not correlated significantly with judges' ratings of wrestling in the present study."

Procedure

The subjects of this study were 78 male students between the ages of 17 and 28. They were enrolled in five classes of an eight-week course of advanced swimming in the required physical education program at the Pennsylvania State University for the acadamic year 1956-57. Each class met for 50 minutes, three times a week, at the Glennland swimming pool, a 90 ft. x 45 ft. pool.

At the beginning of every class meeting during a six-week period, each student was required to do the following routine within ten minutes.

1. Two 60-yard sprints at three quarters speed, using only the American crawl stroke.
2. Flutter kick for 60 yards, using no arm stroke.
3. Arm pull for 60 yards, using no leg kick.
4. One 30-yard sprint at full speed, using the American crawl stroke.

Also, during this six-week period the students were taught a sprinter's start from the end of the pool and these strokes: the side, overarm side, trudgen, trudgen crawl, American crawl, breast, elementary back, inverted breast, and back crawl.

During the seventh week, three American Red Cross Instructors rated the members of the various classes on their ability to do the nine strokes that they had been taught. Each subject was rated on his ability to do the leg kick, arm stroke, rhythmic breathing, and combined stroke for each of these nine strokes. The ratings were based on the following eight point scale:

8 — Excellent
6-7 — Above Average

4-5 — Average
2-3 — Below Average
1 — Failure

The swimming ability score for each subject was the mean rating of the 27 scores received from the three American Red Cross Instructors (three ratings in each of the nine strokes). The degree of agreement among the three judges for each subject's rating never varied more than one or two points.

A 30-yard sprint of each subject was timed by an experienced timer with a stop watch calibrated in tenths of a second. The time was checked every class period during the seventh week for the 30-yard sprint. To eliminate turns, the swimmer swam one length of the 90-foot pool, using the American crawl stroke. The timer stood directly behind the swimmer when he started. The swimmer started at his discretion. As the swimmer's feet left the end of the pool, the timer started the stop watch. The timer then proceeded to trot to the opposite end of the pool and stood directly above the swimmer's lane. The watch was stopped when the swimmer first touched the end of the pool with either hand. The fastest time of three trials swum by each individual was used in this study.

Before the classes met on the eighth week, the Bass Stepping Stone Test for Dynamic Balance was laid out on the floor of the Physical Education Laboratory at Recreation Hall. A diagram of the test can be found in McCloy and Young's book (9, *pp. 106-107*). The students had been instructed to wear rubber-soled shoes to class for testing purposes.

A steel tape was used to measure the distance between the circles. The angles were measured by a protractor. The circles, measured by a compass, were drawn on the floor with chalk. Adhesive tape was placed over the chalk marks to enable the subjects to see the circles more clearly. Strips of adhesive tape were placed between the circles for directional purposes for the students. An experienced timer and a recorder were obtained for the administration of the Bass Test. The timer used a stop watch for timing the performer.

When the classes met, written instructions on the procedures, rules, and deduction of points for errors on the Bass Test were read to the group (9, *pp. 106-107*). After the instructions were read, a demonstration was given. During the demonstration the instructions were reiterated, and all questions pertaining to the test were answered.

Each individual was allowed two practice trials without the use of the circles. Every performer had at least a five-minute rest between the practice trials and the actual test. After each individual completed his trials, the test was administered and scores were recorded. The performers were allowed a ten-minute rest between the first and second, and between the second and third trials.

Analysis of Data

In order to determine if balance (the particular aspect of balance purported to be measured by the Bass Test) was a factor in ability and speed in swimming, the 78 subjects were divided into two groups according to the

scores that they had received on the Bass Test of Dynamic Balance. The students with the upper 39 scores were classified as having "good" dynamic balance, and the individuals with the lower 39 scores as having "poor" dynamic balance.

DYNAMIC BALANCE AND SWIMMING ABILITY

A critical ratio of 12.30 was obtained between the mean scores of the "good" and "poor" dynamic balance groups on swimming ability as rated by three judges. This t ratio was significant at the 1 per cent level of confidence and indicated that balance may be an important factor in swimming ability. A relatively high and significant correlation coefficient of .65 ± .07 was obtained between the scores of the subjects on the Bass Test of Dynamic Balance and the judges' ratings of swimming ability.

TABLE 1

Correlation Coefficients and t Ratios Between Dynamic Balance and Speed, and Dynamic Balance and Ability in Swimming for 78 Male College Students

Groups	Speed in Swimming						
	M[1]	σ	σ_m	$\sigma_{diff.}$	t	r	σ_r
Group with Good Dynamic Balance (39)	18.1	3.16	.51	.4497	15.12[2]	—.75	.05
Group with Poor Dynamic Balance (39)	24.9	4.26	.68				
	Ability in Swimming						
	M[3]	σ	σ_m	$\sigma_{diff.}$	t	r	σ_r
Group with Good Dynamic Balance (39)	6.4	.98	.16	.1382	12.30[2]	.65	.07
Group with Poor Dynamic Balance (39)	4.7	1.08	.17				

[1]Speed in swimming expressed in seconds.
[2]Significant at more than the 1 per cent level of confidence.
[3]Ability in swimming expressed in ratings from judges on an eight point scale.

DYNAMIC BALANCE AND SPEED IN SWIMMING

A t ratio of 15.12 was obtained between the mean scores of the "good" and "poor" dynamic balance groups on speed in swimming. This critical ratio was significant at the 1 per cent level of confidence and indicated that balance may be an important factor in speed in swimming. A relatively high and significant correlation coefficient of —.75 ± .05 was obtained between the scores of the subjects on the Bass Test of Dynamic Balance and speed in swimming the 30-yard sprint. This minus r must be interpreted thus: the better the balance score obtained the faster the speed in swimming.

Summary and Conclusions

The subjects of this study were 78 male students enrolled in the advanced swimming program at the Pennsylvania State University during the academic year 1956-57. All subjects were classified as advanced swimmers, were

taught nine swimming strokes, and were put through a conditioning program during a six-week period. These subjects were then rated on their ability to swim the nine strokes, timed three separate times for the 30-yard sprint in swimming, and given the Bass Test of Dynamic Balance.

The findings of this study seemed to indicate the following conclusions.

1. In general, individuals who have better dynamic balance, as determined by the Bass Test of Dynamic Balance, can swim faster than individuals who have poor dynamic balance.

2. Individuals with better swimming ability, as determined by expert judgement, tend to have better dynamic balance than individuals with poor swimming ability.

3. Dynamic balance, as measured in this study, is not a chance factor and may be an important factor in speed and ability in swimming. Further study is needed to determine whether there is a cause and effect relationship between these factors.

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(Submitted 5/17/57)

Value of Academic Grades in Estimating Student Teaching Success

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Abstract

A comparison was made between academic grades and student teaching grades to determine the value of academic grades in estimating student teaching success of male students majoring in physical education at the University of California, Los Angeles. Analytical tools used in this study were student (Fisher) t ratios and variance ratios. Scholarship record achievement levels for admission to the student teaching program were established for male subjects.

A MAJOR problem of teacher preparation institutions in the area of pre-service teacher education is the selection from among prospective candidates of those most likely to become a success in the profession. The problem of how this selection can best be made has long been of great concern to educators interested in professional preparation. Numerous investigations have been made in the general area of teacher selection. Many have been concerned with attempts to establish factors which could be used for estimating success during the pre-service period. Comparatively few studies, however, have attempted to utilize the undergraduate scholarship records of prospective candidates for estimating success in the student teaching experience and thus as a basis for the elimination of candidates who may be lacking in the requisites for successful teaching.

In the field of general education, such investigations have been conducted by Whitney (7), Zant (8), Broom (1), Ullman (6), Fritz (2), Seagoe (5), and Lins (4). Handy (3) investigated this problem in the field of physical education.

Statement of the Problem

The purpose of this investigation was (1) to determine the value of academic grades received in all university courses exclusive of student teaching, in estimating student teaching success as indicated by student teaching grades, and (2) to establish a scholarship record achievement level that could be utilized as one criterion for admission to the student teaching program.

The following hypothesis was tested: There is no real difference in the student teaching mean grade point and in the mean grade point received in in all academic courses, exclusive of student teaching, for male students majoring in physical education at the University of California, Los Angeles.

Procedure

The subjects for this study were 361 male students majoring in physical education at the University of California, Los Angeles. These subjects were students who had been graduated from the Department of Physical Education during the years 1947 through 1955.

Each subject had two semesters of student teaching at the University of California, Los Angeles. The composite mean grade point for all academic courses exclusive of student teaching, and the student teaching mean grade point were computed for each subject. The University sets the following numerical value for grades, and computations for mean grade point were determined on this basis: A, three grade points; B, two grade points; C, one grade point; and D or less, zero grade points.

The subjects were classified into six groups according to student teaching mean grade point. The mean and standard deviation of the composite mean grade point for all academic courses, exclusive of student teaching, were computed for each group. Student (Fisher) t ratios were computed between each group and every other group.

The subjects were then re-grouped according to mean grade point obtained in all academic courses, exclusive of student teaching. A step interval of .05 was arbitrarily determined, and 20 groups of subjects were defined in this way, ranging from the interval of 1.00-1.04 through the interval of 1.95-1.99. All subjects with an academic mean grade point of less than 1.00 were included in the group defined by the lowest interval, and those with an academic mean grade point higher than 1.99 were included in the group defined by the highest interval. The mean and standard deviation of the mean grade point received in student teaching were computed for each of these groups, and variance ratios were computed among the groups.

Analysis of Data

Means and standard deviations of the composite mean grade point for all academic courses, exclusive of student teaching, for all groups classified by student teaching mean grade point are reported in Table 1. It may be ob-

TABLE 1

Academic Means and Standard Deviations for Groups Classified by Student Teaching Means

Student Teaching Grade Point Mean	Academic Grade Point		
Male Groups	N	M	S.D.
3.0	163	1.604	.308
2.5	56	1.512	.254
2.0	111	1.504	.316
1.5	7	1.300	.192
1.0	17	1.342	.261
0	7	1.180	.150

served that academic mean grade point is generally higher for groups with high student teaching mean grade point than for those with lower student teaching mean grade point.

Table 2 reports t ratios between the mean academic grade point of each student teaching group and every other student teaching group. The hypothesis was rejected at the 5 per cent level of confidence or better, for the following groups:

There is a statistically significant difference between mean academic grade point of subjects receiving a mean student teaching grade point of 3.0, and subjects receiving mean student teaching grade points of 2.5, 2.0, 1.5, 1.0, and 0; between subjects receiving a mean student teaching grade point of 2.5, and mean student teaching grade points of 1.5, 1.0, and 0; and between subjects receiving a mean student teaching grade point of 2.0 and mean student teaching grade points of 1.5 and 0.

TABLE 2

Comparison of Mean Academic Grade Point of Each Student Teaching Group with Every Other Student Teaching Group

Student Teaching Grade Point Mean	Student Teaching Grade Point Mean									
	2.5		2.0		1.5		1.0		0	
	t	df	t	df	t	df	t	df	t	df
3.0	*2.20	217	*2.63	272	*3.75	168	*3.75	168	*6.52	168
2.5			.17	165	*2.46	61	*2.33	71	*4.81	61
2.0					*2.43	116	1.93	126	*4.76	116
1.5							.41	22	.12	12
1.0									1.82	22

*Significant at 5 per cent level of confidence, or better.

It appears that there is a real difference between the academic mean grade point of male student teachers in physical education who receive a grade of A for two semesters of student teaching, and for those who receive any other combination of grades.

Male student teachers receiving a grade of B for two semesters, or an A-B, or A-C combination, appear to be from the same population, and the hypothesis is tenable for these two groups.

There appears to be a real difference between the academic mean grade point of male student teachers in the B group (2.5 or 2.0) and student teachers receiving combinations of B-C, C-D, or less.

Data in Table 3 show the summary of analysis of variance applied to student teaching mean grade point when subjects were re-grouped according to academic mean grade point. There is a statistically significant difference among the student teaching mean grade point of male subjects receiving academic mean grade points of 1.00 or less, through 1.99 or higher; of 1.00 or less through 1.54; of 1.00 or less through 1.19; and of 1.20 through 1.74.

TABLE 3

Summary of Analysis of Variance Applied to Student Teaching Grade Point Means for Male Subjects, Grouped by Academic Grade Point Means

Academic Grade Point Mean	Source of Variation	Sum of Squares	df	Variance	F
1.00 (or less)-1.99 (or higher)	Between Groups	33.96	19	1.787	*4.501
	Within Groups	135.45	341	.397	
	Total	169.41	360		
1.00 (or less)-1.54	Between Groups	21.86	10	2.186	*4.132
	Within Groups	94.72	179	.529	
	Total	116.58	189		
1.20-1.54	Between Groups	6.00	6	1.000	2.062
	Within Groups	65.00	134	.485	
	Total	71.00	140		
1.00 (or less)-1.19	Between Groups	11.71	3	3.903	*5.995
	Within Groups	29.29	45	.651	
	Total	41.00	48		
1.20-1.64	Between Groups	5.75	8	.718	1.701
	Within Groups	78.25	185	.422	
	Total	84.00	193		
1.65-1.99 (or higher)	Between Groups	.91	6	.151	.592
	Within Groups	28.25	111	.255	
	Total	29.16	117		
1.20-1.69	Between Groups	7.11	9	.790	1.547
	Within Groups	103.50	206	.502	
	Total	110.61	215		
1.20-1.74	Between Groups	10.03	10	1.003	*2.619
	Within Groups	86.20	225	.383	
	Total	96.23	235		

*Significant at 5 per cent level of confidence, or better.

The hypothesis is rejected at the 5 per cent level of confidence or better for these groups.

No real differences exist among the student teaching mean grade points of male subjects receiving academic mean grade point of 1.20 through 1.54, 1.64, or 1.69, or for subjects grouped from 1.65 through 1.99 or higher.

It appears, therefore, that academic mean grade points of 1.20 or 1.70 are achievement levels which might be utilized for admission of male physical education major students to the student teaching program at the University of California, Los Angeles. Other possible discrimination levels which appear in the lower intervals are 1.05 and 1.15, which may be used if screening is desired only within the lower levels.

Conclusions

It may be concluded that academic grades received by male students majoring in physical education at the University of California, Los Angeles,

have value in estimating student teaching success as measured by student teaching grades.

It may also be concluded that academic mean grade point achievement levels of 1.20 or 1.70 could be utilized as a basis for admission of male physical education major students to the student teaching program.

Recommendation

It is suggested that studies of a similar nature may be utilized by teacher preparation institutions in providing information unique to each institution which would serve as one factor in screening student teaching candidates.

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(Submitted 4/6/57)

Hip Flexibility of College Women as Related to Length of Body Segments[1]

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Abstract

Sixty-six college women were measured on three hip flexibility tests, an Adapted Kraus-Weber Floor Touch Test, Leighton Flexometer, and Wells Sit and Reach. The purpose of the study was to determine the relationship between the three selected tests of hip flexibility in the antero-posterior plane and the following anthropometric measures: distance from greater trochanter to floor, standing reach, and standing height. Results indicate: (1) No significant relationship between the flexibility of the hipjoint in the antero-posterior plane and the length of body segments; (2) The Adapted Kraus-Weber is the most objective of the three flexibility tests; (3) The Wells Sit and Reach and Adapted Kraus-Weber tests correlate .95.

FLEXIBILITY is most commonly defined as the range of joint motion. Although the term is apt to be used rather loosely, one must recognize that such factors as muscle extensibility, joint structure, condition of ligaments and fascia surrounding the joint, all in some manner affect the range of movement. Considerable attention has been given this subject in both physical education and physical medicine literature. Physical educators have been aware of flexibility as an asset to good performance in athletics, particularly in track and swimming. Although it is generally recognized that adequate range of movement is important in athletic performance and as a safety factor in preventing muscle injury, no one has scientifically determined what constitutes a satisfactory amount of flexibility.

Cureton (1) suggests that flexibility exercises, if built up to sufficient dosage, may condition muscles, tendons, ligaments, and bones to greater tensile strength and elasticity. These factors are basic to successful performance in skills as well as fundamental to the prevention of injuries. On the other hand, an extremely flexible individual may not have the structural qualities which will provide adequate stability.

In 1932 the Japanese and other Olympic swimmers were tested for joint flexibility (1). The four Japanese team members who broke the world's 880-yard relay record by 38 seconds averaged 31.3 per cent greater in trunk flexion than did the American team. Furthermore, the average of 21 Olympic swimmers was shown to be superior to 100 college competitive swim-

[1] This investigation was supported in part by funds provided for biological and medical research by the State of Washington Initiative Measure No. 171.

mers by 11.4 per cent in ankle flexion and 7.7 per cent in trunk flexion. McCue (6) has shown that when comparing more active and less active groups of college women, the former tend to be more flexible than the latter.

In the field of physical medicine, Kraus (3) has indicated that insufficient flexibility may be a predisposing factor to orthopedic conditions such as low back pain. Cureton (1) claims the elasticity difference between a one-year-old child and a 74-year-old adult is 80 per cent. These older individuals are therefore particularly susceptible to the rupturing of muscle fibers.

A variety of instruments such as arthrometers, flexometers, and goniometers have been devised for appraising flexibility of the human body. As McCue (6) has recently summarized these methods, no further mention of them will be made here.

Purpose of the Study

There has been some question as to whether the ability to touch the floor from a standing position is dependent somewhat upon length of body segments, particularly the length of legs. It was for this purpose that 66 college women students from physical education classes were subjects in determining the relationship among three tests of flexibility of the hip joint and length of body segments.

Procedures

The tests of hip flexibility used in this study were an Adapted Kraus-Weber Floor Touch Test, the Leighton Flexometer, and the Wells Sit and Reach Test. The anthropometric measures included distance from the greater trochanter to the floor, standing reach, and standing height.

These tests were administered in the following manner.

Adapted Kraus-Weber Floor Touch Test. The subjects were tested in their stocking feet as described by Kraus (4) with one exception, that the test was performed on a stall bar bench. A 20-inch scale was attached to the bench so that the exact inches, read to the nearest one-half inch the subject could reach, were recorded. In this way the subject was scored according to the number of inches she could reach above or below her toes rather than on a "pass" or "fail" basis.

The Leighton Flexometer. The test was administered in the manner described by Leighton (5) at the same time measurement for the Kraus-Weber flexibility test was made. While one examiner read from the flexometer to the nearest degree, another investigator recorded to the nearest one-half inch the point at which the subject's fingers were extended down the 20-inch scale.

Wells Sit and Reach. A platform scale resting on crossed stem boards and raised a foot from the floor as described by Wells (8) was used in this test. The subject sat with feet firmly placed in the footprints diagrammed on the cross board. The arms were extended forward with the hands placed palms down on the upper surface of the scale. The subject bobbed forward four times and held the position of maximum reach on the fourth count. The

most distant point reached on the fourth bob was held and the reading from the scale was recorded to the nearest half inch.

Distance from Greater Trochanter to Floor. The subject stood in her stocking feet, weight evenly distributed and feet about two inches apart. The center of the greater trochanter was located and measurement was made by means of a Gulick tape from this point to the floor.

Standing Reach. A sheet of paper with one-half inch ruled lines was placed on the wall 60 inches above the floor. The subject stood in stocking feet, facing the paper with toes and chest touching the wall. She was instructed to reach as high as possible with both hands; the distance was recorded to the nearest half-inch.

Standing Height. A stadiometer was employed to determine the subject's height in stocking feet; measurement was to the nearest half inch.

As the subjects reported to the laboratory the measurements of height, distance from the greater trochanter to the floor, and height of reach were recorded. Following these measurements, the flexibility tests were administered. In order to weight the factor of the effects of the preceding flexibility test on the succeeding test, the subjects were divided into two groups. One group was administered the Adapted Kraus-Weber and Flexometer tests first, while the other group was given the Wells Sit and Reach Test first.

Analysis of Data

All coefficients of correlation reported in this study were computed by the Pearson Product-Moment method using 66 cases. Therefore, on the basis of the null hypothesis, an r must be at least .243 or .316 to reach significance at the .05 and .01 levels of confidence respectively (2).

To demonstrate the competency of the examiners in administering the three flexibility tests and in measuring the distance from the greater trochanter to the floor, two teams of investigators measured the same subjects on alternate days. Table 1 contains the objectivity coefficients of these measures.

TABLE 1

Objectivity Coefficients for Three Hip Flexibility Tests and One Anthropometric Measurement

Tests (N = 66)	r
Kraus-Weber	.98
Leighton Flexometer	.88
Wells Sit and Reach	.87
Greater Trochanter to Floor	.84

The correlation of .98 obtained for the Adapted Kraus-Weber test may be considered exceptionally good. Using 215 elementary school children, Phillips, *et al* (7) by means of Yule's Q found the objectivity for this test, when scored on a pass or fail basis to equal .954.

The r of .88 for objectivity of the Flexometer test was considered acceptable in this study. Leighton (5) obtained a reliability coefficient of .99 using 56 male college students.

Wells and Dillon (8) report an objectivity coefficient of .98 for the Sit and Reach Test, using 100 women students. The correlation of .87 obtained in this study, although considered acceptable for further analysis, is not nearly as high as that reported by the original investigators.

It was felt the r of .84 for objectivity of the measurement from the trochanter to the floor was satisfactory because of the difficulty in certain subjects of locating the exact center of this anatomical landmark.

To determine whether the hip flexibility tests gave comparable results, the three measures were intercorrelated. Table 2 contains the results of the intercorrelations.

TABLE 2
Intercorrelations of the Three Flexibility Tests

Tests (N = 66)	r
Kraus-Weber vs Wells Sit and Reach	.95
Kraus-Weber vs Leighton Flexometer	.80
Leighton Flexometer vs Wells Sit and Reach	.74

The Adapted Kraus-Weber and the Wells Sit and Reach tests compare favorably. The r of .95 between the two tests indicates they could be used interchangeably for measuring the flexibility of the hip joint. There is a fairly good relationship between the Adapted Kraus-Weber test and the Flexometer. However, the r of .74 between the Wells and Flexometer tests is too low to consider using one test in lieu of the other.

In order to determine whether length of body segments is related to the hip flexibility scores, the three tests were correlated with distance from greater trochanter to floor, standing reach, and height. Table 3 contains the results of this analysis.

As can be seen from the table, the nine correlation coefficients range from —.147 to .20 and are not significant. From these results, one must conclude that flexibility of the hip joint as measured by the three tests is not related to either standing reach, lower limb length, or standing height for the college girls sampled in this study.

Summary and Conclusions

Three hip flexibility tests, the Adapted Kraus-Weber Floor Touch test, Wells Sit and Reach, and Leighton Flexometer were administered to 66 freshman girls. Also, three anthropometric measures were taken, which included distance from greater trochanter to floor, standing reach, and standing height. The purpose of the study was to determine the relationship of the flexibility tests to length of the selected body segments.

No significant relationship was found between the three tests of flexibility and the three anthropometric measures.

TABLE 3
Relationship Between Three Hip Flexibility Tests and Three Anthropometric Measures

Tests (N = 66)	r
Adapted Kraus-Weber vs Standing Reach	—.147
Wells Sit and Reach vs Standing Reach	—.188
Leighton Flexometer vs Standing Reach	—.112
Adapted Kraus-Weber vs. Lower Limb Length	.008
Wells Sit and Reach vs Lower Limb Length	—.066
Leighton Flexometer vs Lower Limb Length	.164
Adapted Kraus-Weber vs Standing Height	.005
Wells Sit and Reach vs Standing Height	—.05
Leighton Flexometer vs Standing Height	.20

The intercorrelation of the flexibility tests revealed that the Adapted Kraus-Weber and Wells Sit and Reach tests could be used interchangeably, as the resulting r equaled .95.

The most consistent results for measuring flexibility of the hip joint were obtained in this study when the Adapted Kraus-Weber Floor Touch test was used.

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(Submitted 4/18/57)

Effect of Warm-up on Softball Throw for Distance[1]

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Abstract

The purpose of this study was to investigate the effects of related and unrelated warm-ups on the distance a 12-inch softball could be thrown. The subjects, 77 college men, threw three softballs for distance with no preliminary warm-up, with a preliminary five-minute related throwing warm-up and with a preliminary five-minute non-related general warm-up. The results showed that both types of warm-ups resulted in significantly longer throws. There was no significant difference between the various types of warm-up and no significant warm-up effect was demonstrated between trials 1 and 3 on a particular day of testing. The time spent and the strenuousness of the warm-up appeared to be factors involved in improving the distance the balls were thrown.

TODAY there is a great deal of controversy regarding the effects of warm-up prior to an activity. Many people are of the opinion that warm-up prepares an individual for a maximum performance. There are those, however, who question these opinions and have shown evidence to the effect that warm-up is not especially beneficial.

The experimental evidence to show the effects of warm-up is rather scanty and in some instances contradictory. Simonson, Teslenko, and Gorkin (7), experimenting with seven subjects, found that preliminary exercise improved the running time of the 100-meter run by an average of 7 per cent.

Asmussen and Bøje (1) were able to show, with the exception of massage, that preliminary exercise, short wave diathermy, and hot shower types of warm-up were beneficial for short sprint and endurance type rides on a bicycle ergometer. The two standard performances on the bicycle ergometer simulated a 100-meter sprint and a 1500-meter run. They found that, with warm-up, a given amount of work could be performed better, i.e., in a shorter time, and greater muscle tension could be developed. Also, the maximum oxygen uptake was slightly higher, but the oxygen necessary for a given amount of work was reduced. They concluded that a higher temperature in the muscle benefits the ability to perform work by accelerating the chemical processes in the muscle, and probably also by decreasing the intra-muscular viscous resistance.

Schmid (6) found that both active and passive methods of warming-up were beneficial for swimming 50 meters, running 100 meters, and riding a

[1] This study was supported in part by University of California Faculty Research Grant No. 121.

bicycle. The most effective active warm-up method was found to be that which employed the same motions involved in the actual performance.

Blank (2), in experimenting with 16 track and field athletes in the 120-yard run, and 38 non-athletes in the 100-yard run, found a significant difference (1% level of probability) in improved running time in favor of warming-up.

In contrast with the above reports, Karpovich and Pestrecoy (4) were able to show that the riding times on a bicycle ergometer were actually reduced when a warm-up was taken prior to the ride.

Karpovich and Hale (5) found no significant differences in the running times of the 440-yard run or the sprint type rides on the bicycle ergometer when either preliminary exercise, deep massage, or digital stroking methods of warm-up were used. No significant differences were found in the running times of the 440-yard run and riding times on the bicycle ergometer when these methods of warm-up were compared to no warm-up.

Hodgkins and Skubic (3) investigated the effects of no warm-ups, general, and related methods of warming-up on speed, strength and accuracy, using 31 college women as subjects. They found no significant differences in the scores made in relation to the three warm-up conditions. In their study, the warm-up periods were short (approximately one minute in duration), simulating the type and duration of warm-ups given girls in their physical education classes.

Procedure

SUBJECTS

The subjects for this investigation included 77 male students in good health from the activity classes of the Department of Physical and Health Education at the University of California, Santa Barbara College. The ages ranged from 17-20 years. Fifty-one of these subjects participated in a test-retest for reliability.

WARM-UP METHODS

In addition to performing the softball throw without warm-up, two methods of warm-up were investigated. The related method was a specific warm-up using the identical action of the test activity. It consisted of playing catch with a softball for five minutes—one minute at 25 feet, one minute at 50 feet, one minute at 75 feet, one minute at 100 feet and one minute at the farthest distance the subjects could throw. In the event a ball was missed, another ball was put into play immediately in order to prevent any loss of time.

The unrelated method was a general body warm-up not similar to the test activity. It consisted of a combination of calisthenics and sprint running for five minutes, one minute of jumping jacks, one minute of toe-touching from a standing position, one minute of alternate toe-touching from a standing position, and two minutes of sprint running, which consisted of four sprints around a football field.

THE TEST

The subjects were divided into three groups with the sequence of warm-up methods alternated on different days in order to reduce the possibility of a practice effect in favor of any one method.

Three throws for maximum distance were allowed for each testing period. The distance of the throws was measured to the nearest one-tenth of a foot.

Results

In establishing reliability, 51 subjects were retested one week following the completion of the initial tests. The subjects were randomly divided into three groups, one group repeating the test without warm-up, one group preceding the throws with a related warm-up, and the third group preceding the throws with a general warm-up. The data were then compared with that of the first series of tests. The results are presented in Table 1. The reliability of the throws for distance ranged from .87 with no warm-up to .90 with both related and general warm-ups. The day to day fluctuations ranged from an average of 1.6 feet to 9.4 feet, with an over-all average difference of 6.3 feet for all subjects. The range of distances thrown was from 54 to 293 feet with a mean of 178 $\pm$ 41.4 feet.

In the main series of tests, each subject threw three softballs for distance each testing day. An analysis was made of the differences between these three trials (see Tables 2 and 3). The three throws after related warm-ups were the least variable, the mean difference between the trials ranging from .4 feet to 1.1 feet. The greatest variability between trials was found with unrelated warm-up, the difference in distances ranging from 1.9 feet to 4.3 feet. The distance of the throws usually increased from trial 1 to trial 3, with the mean difference reaching the 10 per cent level of significance when the unrelated warm-up preceded the throw. This increase in distance between trials 1 and 3 indicates a possible warm-up effect, occurring after only one or two throws, although the differences between trials were not statistically significant beyond the 10 per cent level of confidence (Table 3).

Table 4 presents the results of the experiment showing the effect of the warm-up methods on the softball throw for distance. On separate days, the subjects threw for distance with no warm-up, with a warm-up related to the activity and with a warm-up which was unrelated to the activity. The average of the throws for distance after an unrelated warm-up was 7 $\pm$ 2.17 feet farther than when no warm-up was taken. The average distance with related warm-up was 5.9 $\pm$ 1.75 feet farther than when no warm-up was taken. These differences in distances were statistically significant beyond the 1 per cent level of probability. No significant difference was found when the related method was compared to the unrelated method.

Discussion

In this type of study, it is difficult to rule out the psychological effects of warm-up. Though the subjects were told that warm-up probably has no effect

TABLE 1
Test-Retest Data with One Week Between Tests
(N = 51)

Data	No Warm-up		Unrelated Warm-up		Related Warm-up	
	1st Series	2nd Series	1st Series	2nd Series	1st Series	2nd Series
	(feet)	*(feet)*	*(feet)*	*(feet)*	*(feet)*	*(feet)*
Total	9,112.10	9,511.60	8.894.00	9,346.90	9,521.20	9,442.10
Mean	168.70	176.70	185.30	194.70	186.70	185.10
S.D.	10.05	10.20	9.90	9.64	12.20	11.60
δ m	2.37	2.41	2.47	2.41	2.96	2.82
r	.87		.90		.90	
N	18		16		17	

TABLE 2
Comparison of Trials Taken Under Three Different Conditions
(N = 77)

Trial	*No Warm-up*	*Unrelated Warm-up*	*Related Warm-up*
	(Mean distance in feet)		
1	172.8	178.6	179.5
2	174.8	180.5	179.1
3	173.5	182.9	180.2
Mean	173.7	180.7	179.6
S.D.	40.6	42.5	41.0
δ m	4.64	4.85	4.68

TABLE 3
Comparison of Three Trials Taken on One Day
(N = 77)

Trials	Mean Diff. (feet)	δ d	δ md	t	P
		No Warm-up			
1–2	2.0	14.1	1.62	1.17	.30
2–3	—1.3	9.7	1.11	1.09	.30
1–3	.7	14.9	1.71	.82	.70
		Unrelated Warm-up			
1–2	1.9	13.0	1.49	1.00	.40
2–3	2.4	12.3	1.41	1.70	.10
1–3	4.3	15.5	1.78	1.97	.10
		Related Warm-up			
1–2	—.4	12.0	1.37	.51	.70
2–3	1.1	12.0	1.38	.94	.40
1–3	.7	15.4	1.76	.17	.90

TABLE 4
Relationship Between Warm-up Conditions
(Mean of three trials)
(N = 77)

Conditions	Mean Diff. (feet)	δ d	δ md	t	P
No Warm-up—Unrelated Warm-up	7.0	18.87	2.17	3.32	.01
No Warm-up—Related Warm-up	5.9	15.23	1.75	3.37	.01
Unrelated—Related Warm-up	—1.1	13.89	1.59	.69	.70

on throwing and prevention of injuries, there was some discussion among a few subjects concerning the need for warm-up before throwing. If warm-up is in part a phenomenon of the mind, then it will be difficult to eliminate such

a factor from this study. By testing subjects who were not athletes, the strong feeling concerning the need to warm up was probably minimized. When it was felt that a subject was prejudiced in favor of warm-up, and therefore not making an all-out effort on the days when no warm-ups were given, his data were withdrawn from the study.[2]

In the present study, the beneficial effects of a strenuous warm-up are borne out regardless of whether the effects were due to a physiological or psychological phenomenon. It is possible that when there is a sudden stretch, as in a distance throw, performance is improved by elevating the muscle and general body temperature. Another possible explanation for the benefit of warm-up is the overcoming of the stretch reflex. Although Skubic and Hodgkins (3) used the same testing procedure to determine the effect of warm-up on a softball throw for distance, they found no beneficial effects from warm-up. It is possible that their warm-ups, which were of one minute duration and not strenuous in nature, were not sufficient to produce increased performance. On the other hand, five minutes of warm-ups did increase performance in the present study. It appears that the intensity of the warm-ups and the duration of the warm-ups are pertinent factors in activities involving explosive strength.

In analyzing the trials in Tables 2 and 3, it can be noted that there was an increase in distances thrown from trial 1 to trial 3, but none of the differences between the trials was statistically significant.

The mean difference of only 1.1 feet between the two types of warm-up suggests that both types were equally effective in improving performance in a strength type of activity such as the softball throw. Apparently, the effects of warm-up depend upon the type of activity involved and the intensity of the warm-up activity. Other studies have shown that activities involving speed, strength and accuracy are not benefited by light warming-up (3; 5). In the present study, a five-minute period of medium hard exercise was sufficient to show significant differences.

Regardless of whether a warm-up was used or not, there were no reports of muscle soreness. It is not known whether soreness or injuries would have resulted if the warm-ups had been more or less strenuous or if more throws had been involved in the test.

Summary

Seventy-seven male students in required physical education classes at Santa Barbara College were given a softball throw for distance without warming-up, with five minutes of related warm-up, and with a five-minute general unrelated warm-up preceding the throwing. Each subject was given three trials on three different days of testing with the warm-up methods alternated, so that one group would first be tested with no warm-up, the second group with related warm-up, and the third group with unrelated warm-up. This study

[2]All data for two subjects were eliminated from this study.

was conducted to determine whether warm-up improves performance in a throwing activity.

The results are as follows:

1. There was no significant difference between the related and unrelated methods of warm-up.

2. Subjects threw softballs farther when throws were preceded by warm-ups than they did when no warm-ups were taken preceding the throws. The differences were statistically significant at the 1 per cent level of probability.

3. The distances associated with related warm-up were 5.9 ± 1.75 feet farther than with no warm-up, and with unrelated warm-ups the throws were 7.0 ± 2.17 feet farther than with no warm-up.

4. The range of all throws was from 54 feet to 290 feet, with a mean of 178 ± 41.4 feet.

5. There was no report of muscle soreness, regardless of whether a warm-up preceded the throws or not.

6. There were no significant differences among the three trials on any testing day although there was a trend toward slightly longer distances on the third throw.

7. Test-retest reliability for three warm-up methods was from .87 to .90 with an average day to day variability of 6.3 feet. The results indicate daily consistency of effort on the part of the subjects.

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Studies of Transfer of Learning in Gross Motor Skills[1]

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Abstract

Ninety men taking college physical education classes learned six paired gross motor skills with order and method of teaching as variables. Observations seem to warrant the following general conclusions: (1) Skills and activities which involve similar elements and patterns should not be learned at the same time; (2) The method of deliberate teaching for transfer of learning (at the beginning levels of learning) appears to be ineffective in the subsequent learning of skills with similar patterns and movements.

EDUCATIONAL programs in general are founded on the premise that human beings have the ability to transfer that which they learn to subsequent situations. This is evident in everything from the early training of children in the home to the classical college curriculum. The problems of transfer of learning are vast and exceedingly complex. Experimentation in the area of motor learning has been carried on chiefly in psychological laboratories and has involved the learning of fine motor skills. It is expected that certain of these findings also apply to the learning of gross motor skills. However, two questions still appear to be paramount: 1. To what range of situations will a particular learning transfer? and 2. What instructional methods promote the greatest degree of transfer of learning?

Statement of Problem

The purpose of this investigation was to study transfer to learning in gross motor skills which involve some similar elements and patterns. The problem was divided into three general areas and was approached by: 1. Determining the extent of transfer of learning between two activities which involve some similar elements and patterns when these skills are learned at the same time; 2. Determining the extent of transfer of learning between two activities which involve similar elements and patterns when these skills are not learned at the same time; 3. Determining the extent of a possible transfer of learning when one of the objectives is the purposeful teaching for transfer.

Procedure

In order to carry out the purposes and objectives of the problem, six skills were selected and paired for study. Skills one and two, three and four, five and six were paired.

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[1]This study was carried out in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Graduate School, University of Southern California, under the direction of Dr. Aileene Lockhart.

SKILL ONE. BADMINTON VOLLEY AGAINST A WALL

The subject stood behind a line drawn six feet from a handball court wall and stroked a plastic shuttlecock against the wall, using either a forehand or backhand stroke. The shuttlecock had to be hit between the height of the subject's shoulder and ankle. If the outlined sequence of activity was not followed, only the strokes meeting the listed qualifications were counted. When the shuttlecock fell on the floor, the subject retrieved it and began again. Scores were cumulative. The number of successful hits made in 30 seconds constituted a subtotal score. Each day's total score consisted of five 30-second periods of activity, or five subtotal scores.

SKILL TWO. TENNIS STROKING AGAINST A WALL

The subject stood behind a line drawn 20 feet from the wall and stroked a tennis ball after one bounce; either the forehand or backhand stroke was allowed. A dark-colored line was drawn across the front wall of a handball court three feet above the floor. A restraining line 20 feet from and parallel to the base of the wall was placed on the floor.

Two tennis balls were provided for each subject as he took the test. A brown cardboard box 12 inches long, 9 inches wide and 6 inches deep, containing ten extra balls, was placed on the floor at the junction point of the restraining line and the side wall. The box containing the extra balls was placed to the left side for right-handed subjects and to the right side for left-handed subjects.

The method of scoring followed the same procedure as that used in badminton; only those hits were counted that met the required specifications; that is, hitting the front wall only, above the three-foot line, and returned by the subject from behind the 20-foot restraining line.

SKILL THREE. VOLLEYBALL TAP FOR ACCURACY

The volleyball was put in motion by having it run down a trough located 13 feet above the floor. The ball was placed in the trough at the same place each time from a balcony overlooking the basketball court. As the ball rolled off the trough, the subject jumped in the air and tapped the ball over a standard eight-foot-high volleyball net to a target lying flat on the floor on the other side of the net. The target was an eight-foot square of canvas lined with concentric circles six inches apart. A value of seven was given to hits within the center circle and each succeeding circle from the center was assigned one less. Forty-two inches away from the center of the target the score was zero. The target was placed 14 feet from the net to the inside edge of the canvas. The subject made five taps with the right hand and five with the left hand in order to complete one series. Five series were scored to complete each day's activity.

SKILL FOUR. BASKETBALL TIP FOR ACCURACY

In order to control the action of the ball, the basketball was also put in motion from the trough. Since skills three and four (volleyball and basketball) have characteristics believed to be transferable, it was considered neces-

sary to supply the same kind of controlled stimuluus in both skills. The trough method of putting the ball in play met this requirement. As the ball came off the trough, the subject jumped and attempted to tip it while in the air into a regulation basketball basket. Each subject completed 25 tips from the right side with his right hand each day and 25 tips from the left side with his left hand each day.

Subjects received scores when the ball was tipped during the jump and these scores were assessed on the following empirical basis:

Three points for each basket.
Two points for hitting any place on the upper side of the rim.
One point for hitting the backboard any place above the rim level or the side of the rim.

SKILL FIVE. TRACK STARTING STANCE

The subject used the conventional track starting procedure and ran straight ahead for five yards. On the command "take your marks," the subject assumed the starting position crouched on one knee, hands just behind the starting line, and eyes looking down the track. On the signal "get set," the subject raised his hips until they were slightly higher than his shoulders. The command for action was the clapping of two clap boards which were used to start the clock automatically.

Both skills five and six (track and football start) were performed in the gymnasium on one end of the basketball floor. Subjects were attired in regulation gymnasium suits; powdered rosin was used on the floor to prevent slipping. A strip of adhesive tape was used for the starting and finishing lines. The rod described below was directly over the finish line.

The electric timing device used for scoring was accurate to the nearest one-hundredth of a second. The clock was started by clapping two boards together. The boards were lined with sheet copper to which electric wires were attached. As the sheets of copper came together, the clock started and continued until the runner broke the electric circuit which was controlled by a rod, waist high, across the finish line. This rod was attached to a hinge which controlled a micro switch. When the rod was moved on the hinge, the micro switch cut the current and stopped the clock. Time was recorded to the nearest one-hundredth of a second. Each day's total score included the average of five timed trials following the usual warm-up and teaching procedures.

SKILL SIX. FOOTBALL STARTING STANCE

The starting procedure for this skill was the same as that which was used for the track start. Subjects used the crossover step and ran laterally for five yards. The crossover step is made by taking the first step with the leg farthest from the lateral running direction. If the right foot was used in the forward position, the subject ran to the right. If the left foot was forward, he ran to the left. Scoring was the same as that used in the track start.

Design of the Experiment

The experimental design of the study is shown in Table 1. This table contains the schedule of skills and groups of subjects. It was necessary:

TABLE 1

Schedule of Skills and Groups of Subjects

Group	No transfer taught		With transfer taught		Taught at same time	
I	Section A 1 2	Section B 2 1	Section A 3 4	Section B 4 3	Section A (No transfer taught) 5 & 6	Section B (Transfer taught) 6 & 5
	With transfer taught		Taught at same time		No transfer taught	
II	Section C 2 1	Section D 1 2	Section C (No transfer taught) 4 & 3	Section D (Transfer taught) 3 & 4	Section C 5 6	Section D 6 5
	Taught at same time		No transfer taught		With transfer taught	
III	Section E (No transfer taught) 1 & 2	Section F (Transfer taught) 2 & 1	Section E 3 4	Section F 4 3	Section E 6 5	Section F 5 6

NOTE: Numbers 1, 2, 3, 4, 5, and 6 represent the skills used in the study.

1. To design the experiment so that a series of skills could be repeated under different arrangements of order and method of teaching. This required three groups of subjects.

2. To lessen the effects of prior experience. This was done by subdividing the groups for counter balancing purposes in the skill sequence and also in the three group arrangement.

3. To design the study so that the time involved in carrying out the experiment was not excessive. Three groups of subjects were selected. One group of 30 subjects was studied during each of the three quarters of the school year.

SUBJECTS

Utah State University is located at Logan, Utah, and students are predominately from the surrounding Intermountain area. The majority of students are from the State of Utah.

Subjects who were used in this study were Utah State University boys selected from physical education classes. Selection was necessary in order to meet the requirements of the study. If a subject had had a great deal of prior experience in certain sports related to some of the skills, this condition might have affected the learning of the related skill. For this reason, any subject was eliminated if he had been a sprinter on a track team, played competitive tennis or badminton, or had taken classes in either of the above-mentioned sports.

Additional selection of subjects was made because it was considered important to include representatives of all four years of the college population

in the study; therefore, students from certain classes were selected to give stratification to the subjects. Each of the six groups finally selected included 15 subjects randomly sampled after stratification and elimination of certain subjects who had had prior experience.

Each major group (I, II and III) consisted of 30 boys. These groups were subdivided into Sections A and B from Group I, Sections C and D from Group II, and Sections E and F from Group III. The subdivisions each contained 15 boys; subdivisions were used for counter-balancing purposes. This arrangement made it possible to reverse the order of learning the skills in each subdivision.

Each subject proceeded through the experiment three different days in one week and each skill was practiced three different days before the skill was completed. Each skill required approximately 30 minutes to complete during each session. A total of six weeks was necessary for the subject to complete all six skills. The various groups performed the paired skills under varied conditions, so that three different orders and two different methods of teaching were included. The methods of teaching involved the use of deliberate teaching for transfer of learning as an objective and no use of this objective. The orders of teaching the skills included: 1. The teaching of one of the paired skills followed by the other skill; 2. Reversing the order of teaching the skills; and 3. Teaching the two skills alternately.

Methods of Teaching for Transfer of Learning

When teaching for transfer of learning was a part of the experimental design, carry-over possibilities were taught both at the time of learning the initial skill and upon learning the subsequent paired skill. The teaching of the respective skills involved a verbal explanation of general and specific principles found in the skills. This was followed by a brief demonstration of the skill. The majority of principles which were chosen were specific and applied directly to the respective paired skills. However, a few principles were general and applied to all skills. All subjects were given the same principles.

The importance of the learnings being transferred to other activities was pointed out specifically to the appropriate experimental groups. They were told that there were common elements and patterns of movement in the different activities, and specific examples were given in all of the paired skills. For example, subjects were told that staying low in the track start also applied to staying low in the football stance start, and if they learned it in one skill it should help in the other skill. These cases of similarity were emphasized to all subjects in situations where the purpose of the experiment required the deliberate teaching for transfer of learning.

Examples of the general principles which were taught are:

1. Be aware of transfer situations. Look for similar elements and patterns of movement in activities.

2. Think about the possibilities of transferring learning from one activity to another.

In order to carry out the purposes of the experiment, only those principles which were deemed applicable by the investigator to both paired skills were taught.

Measurement Techniques

Data were derived from two scoring techniques: 1. The use of third-day scores (a measure of final learning), and 2. The difference between the first- and third-day scores (a measure of improvement). Statistical comparisons of the six groups of subjects were made by subjecting the data to analysis of variance.

Summary of Findings

Analyses of the source of variation are presented for each skill and each scoring method in Tables 2 and 3. The data were treated and analyzed on the basis of differences found in the method of teaching, the order of teaching and the interaction between method and order of teaching the six paired skills.

FINAL LEARNING (FINAL DAY SCORES)

Method of Teaching. The mean scores were found to be higher in all six skills when transfer was not a deliberate objective of teaching. In five of the six skills, no significant difference was demonstrated; however, in skill two, the tennis skill, the difference was significant at the 10 per cent level of confidence.

Order of teaching. Tennis appeared to have some favorable effect on learning the badminton skill, but the tennis skill was best when learned first. Differences were not found to be significant, and the hypothesis that these differences can be attributed to chance could not be rejected.

The learning of the basketball skill prior to learning the volleyball skill seemed to contribute to learning the volleyball skill, but differences were not found to be significant. On the other hand, scores were higher in basketball when that skill was learned before the volleyball skill.

The track starting skill was found to be significantly faster when it was learned before the football starting skill. However, the learning of the track start first seemed to produce better time in football, although the differences were not found to be significant.

Interaction of method and order of teaching. When tennis was learned before badminton, the method of deliberate teaching for transfer of learning seemed to be effective, but when badminton preceded tennis, or when both badminton and tennis were learned alternately, this method was not effective.

The deliberate teaching of transfer of learning appeared to be less useful when the volleyball and basketball skills were learned separately and better when the skills were learned alternately. Differences were found to be significant.

The deliberate teaching of transfer of learning was more effective in the football skill when the paired skills were learned separately and less helpful

TABLE 2
Analysis of Variance—Final Day Scores

Skill	Source of Variation	d. f.	Sum of Squares	Mean Square	F
1 (Badminton)	Order	2	1012.35	506.17	.898
	Method	1	82.17	82.17	.146
	M x O	2	842.23	421.11	.747
	Error	84	47353.87	563.71	—
	Total	89	49290.62		
2 (Tennis)	Order	2	251.36	125.68	.813
	Method	1	476.10	476.10	3.083
	M x O	2	1652.59	826.29	4.350
	Error	84	12972.94	154.44	—
	Total	89	15352.99		
3 (Volleyball)	Order	2	5925.9	2962.9	2.24
	Method	1	1337.8	1337.8	1.01
	M x O	2	6056.7	3028.3	2.29
	Error	84	110898.7	1320.2	—
	Total	89	124219.1		
4 (Basketball)	Order	2	287.6	143.8	.40
	Method	1	321.1	321.1	.90
	M x O	2	2318.2	1159.1	3.26
	Error	84	29831.6	355.1	—
	Total	89	32758.5		
5 (Track)	Order	2	.0699	.0349	3.83
	Method	1	.0072	.0072	.79
	M x O	2	.0222	.0111	1.22
	Error	84	.7712	.0091	—
	Total	89	.8705		
6 (Football)	Order	2	.0144	.0072	.80
	Method	1	.0003	.0003	.33
	M x O	2	.0555	.0277	3.08
	Error	84	.7563	.0090	—
	Total	89	.8265		

when learning of the paired skills was alternated. Differences were significant at the 10 per cent level of confidence.

When the skills were the first of the pair learned, the deliberate teaching of transfer of learning was found to be the better method.

IMPROVEMENT (DIFFERENCE BETWEEN THE FIRST AND FINAL DAY SCORES)

Method of teaching. A variation in the amount of improvement was found when the method of teaching the skills was considered.

The only differences found to be significant in the method of teaching were in the track start. In this skill, more improvement was made when transfer

TABLE 3

Analysis of Variance
Difference Between First- and Final-Day Scores

Skill	Source of Variation	d. f.	Sum of Squares	Mean Square	F
1 (Badminton)	Order	2	244.16	122.08	.594
	Method	1	24.33	24.33	.118
	M x O	2	1692.90	846.45	4.120
	Error	84	17256.67	205.44	—
	Total	89	19218.06		
2 (Tennis)	Order	2	81.42	40.71	.554
	Method	1	0	0	3.544
	M x O	2	520.80	260.40	—
	Error	84	6170.93	73.46	
	Total	89	6773.15		
3 (Volleyball)	Order	2	2152.8	1076.4	1.53
	Method	1	834.1	834.1	1.18
	M x O	2	520.1	260.0	.37
	Error	84	5913.4	704.7	—
	Total	89	62700.4		
4 (Basketball)	Order	2	20.6	10.3	.07
	Method	1	67.6	67.6	.46
	M x O	2	292.0	146.0	.99
	Error	84	12363.4	147.2	—
	Total	89	12743.6		
5 (Track)	Order	2	.0151	.0075	5.00
	Method	1	.0160	.0160	10.67
	M x O	2	.0015	.0007	.47
	Error	84	.1246	.0015	—
	Total	89	.1572		
6 (Football)	Order	2	.0166	.0083	1.30
	Method	1	.0241	.0241	3.76
	M x O	2	.0088	.0044	.69
	Error	84	.5376	.0064	—
	Total	89	.5871		

of learning was not deliberately used. The football skill reversed this pattern but differences were found to be significant at only the 10 per cent level of confidence.

No significant difference was found in the method of teaching the badminton, tennis, volleyball, and basketball skills.

Order of teaching. The data in Table 4 indicate that the least improvement in all skills was found when the paired skills were learned alternately. This

TABLE 4
Means[1] for Each of the Six Skills in the Orders of Teaching

Order of Teaching[2]	MEANS					
	1 Badminton	2 Tennis	3 V. B.	4 B. B.	5 Track	6 F. B.
x 1 — 2	53.67	20.47	67.40	20.50	.146	.439
y 2 — 1	55.77	18.87	59.57	20.70	.139	.465
z 1 and 2	51.73	18.20	55.63	19.60	.120	.434

[1]Each mean score represents 15 subjects.
[2]Numbers 1—2 represent skills 1 and 1, and also skills 3 and 4, and 5 and 6.

finding was consistent throughout the study, although in each skill it lacked statistical significance.

The performances of the volleyball, basketball, track, and football skills were found to be most improved when these skills were the first of the pair learned. The badminton and tennis skills reversed this pattern; however, this is the type of condition to be expected, since the effects of positive transfer are to be found in subsequent learnings.

The learning of the basketball skill did not appear to have a favorable effect on improvement in learning the volleyball skill, although differences were not found to be significant.

The badminton skill did not appear to aid the learning of the tennis skill; this was indicated in the analysis of both the tennis and badminton skills. Differences, however, were not found to be significant.

Interaction of method and order of teaching. The deliberate teaching for transfer of learning seemed to result in less improvement when the badminton and tennis skills were learned alternately and more improvement when the skills were learned separately. The track and football skills reversed this pattern. Differences were found to be significant in the badminton and tennis skills, but not in the track and football skills.

Conclusions

Many of the findings of this study are not in themselves statistically significant, nor do they agree in every respect with expectations of various writers. However, the following specific findings resulted:

1. The initial learning of tennis skill seemed to have had some favorable effect on learning the badminton skill.
2. The deliberate teaching for transfer of learning seemed to result in less improvement when the badminton and tennis skills were learned alternately and more improvement when the skills were learned separately.
3. The initial learning of the basketball skill seemed to aid in the final learning of the volleyball skill.

4. The deliberate teaching for transfer of learning was the significantly poorer method in learning the track starting skill.

5. The initial learning of the track start seemed to have had a favorable effect on learning the football stance start.

Within the limitations and restrictions of the experiments which constituted this study, observations seem to warrant the following general conclusions:

1. Skills and activities which involve similar elements and patterns should not be learned at the same time.

2. The method of deliberate teaching for transfer of learning (at the beginning levels of learning) appears to be ineffective in the subsequent learning of skills with similar patterns and movements.

Implications for Teaching

Based on specificity of learning, method of teaching, and interaction of method and order of teaching, the following implications for teaching seem to be justified.

SPECIFICITY OF LEARNING

1. Skills and activities which involve some similar elements and patterns should not be learned alternately if the maximum positive effect of transfer is to be realized.

2. Skills and activities which involve many different techniques should not be presented in a short period of time, nor should two skills involving many different techniques be learned at the same time.

3. The best order for presenting skills and activities which involve some similar elements and patterns is to learn first one skill and then the other.

METHOD OF TEACHING

The findings of this study (with regard to the best method of teaching for transfer) fail to agree with the expectations of certain writers; however, the results of this experiment are not in themselves statistically significant. For these reasons, it is injudicious to draw implications regarding method of teaching. From the results of this study, it appears that it makes little difference whether or not the deliberate teaching for transfer of learning is an objective. Transfer effects may occur in the same amount, regardless of the method of teaching. Under conditions involving longer periods of time, it is entirely conceivable that the possibilities for transfer of learning should be noted and understood by the learner. At any rate, without undisputed evidence to the contrary, it is illogical to assume that anything is lost where there is deliberate teaching for transfer of learning. Certainly the possibilities for gains should not be ignored.

INTERACTION OF METHOD AND ORDER OF TEACHING

1. In the initial stages of separate learning of related skills, it seems that the deliberate teaching for transfer of learning is not of great importance. Perhaps it is of more importance as learning progresses to higher levels.

2. The method of deliberate teaching for transfer of learning appears to be effective when used in teaching subsequent related skills.

(Submitted 3/25/57)

Effect of Swimming on the Learning of Selected Gross Motor Skills

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Abstract

The purpose of this investigation was to study the effect of swimming on the learning and performance of two complex gross motor skills. Forty college men were matched on the basis of a pre-test and formed into experimental and control groups. The experimental group learned the two selected skills in addition to swimming, whereas the control group learned only the selected skills. Two scoring systems were used, and findings indicated no significant difference between groups.

ONE OF THE important reasons for physical education classes is that students are taught sport skills so that these skills will transfer to recreational pursuits involving similar skills outside of the school. The learning of one activity is expected to facilitate the learning of similar activities, and it has been established that transfer of learning is frequently successful (1, 4). Some physical educators are of the opinion, however, that the learning of two activities with similar movements and patterns at the same time will result in negative transfer or interference in learning. In the strict sense of the word, this does not appear to be true, since research by the author (7) recently and by others in the past has indicated differently (8, 6). They have found that learning takes place in similar activities, but the amount of learning is considerably less when the similar activities are learned at the same time, as compared with learning one activity followed by the other activity.

On the other hand, it is also thought that negative transfer or interference will occur in some instances where the skills are dissimilar. The most noted controversy seems to be in the case of swimming during the learning and performance of other sports skills. Among the reasons advanced are: (1) Swimming tends to soften the muscles; (2) Swimming tends to stretch the muscles and make them long; (3) Swimming movements interfere with the learning of other skills; (4) Swimming is harmful to the performance of football players, basketball players, track men, etc.

Apparently there is some conflict and doubt as to what effect swimming has on the learning and performance of gross motor skills. Two important questions which need to be answered in relation to swimming and the learning and performance of gross motor skills are:

1. Does swimming during the learning of gross motor skills result in negative transfer of learning?

2. If swimming does affect the learning and performance of other gross motor skills, is it because of energy expenditure or negative transfer of learning?

Answers to both questions are not complete in one study, but some contribution to the field of learning seems to indicate the importance of research in this area.

Statement of the Problem

The purpose of this investigation was to study the effect of swimming on the learning and performance of selected gross motor skills. The problem was approached by determining the extent of transfer of learning (negative or positive) between swimming and activities which involve dissimilar movements and patterns when these activities were learned at the same time.

Procedure

In order to carry out the purpose of the experiment, two skills, in addition to swimming for the experimental group, were selected for study. It was essential that success in each skill be measured objectively so that the amount of learning could be ascertained. The skills were also designed to represent, in part, some sports where controversy seems to exist in relation to swimming and the learning of particular types of gross motor skills. It is recognized that these skills do not represent all gross motor skills, but they do involve movement patterns found in many gross motor activities.

SKILL 1. VOLLEYBALL TAP FOR ACCURACY

The volleyball was put in motion by having it run down a trough located 13 feet above the floor. The ball was placed in the trough at the same place each time from a balcony overlooking the basketball court. As the ball rolled off the trough, the subject jumped in the air and tapped the ball over a standard eight-foot-high volleyball net to a target lying flat on the floor on the other side of the net. The target was an eight-foot square of canvas lined with concentric circles six inches apart. The target was placed 14 feet from the net to the inside edge of the canvas. The subject made five taps with the right hand and five with the left hand in order to complete one series. Five series, or 50 taps, were scored to complete each day's activity.

SKILL 2. HIGH HURDLES (THREE FLIGHTS)

The high hurdle skill was also performed in the gymnasium using conventional track starting procedure. The course consisted of three flights of standard college high hurdles. Two flights were completed down one side of the gym as follows: Start, ten yards to number one hurdle, ten yards to number two hurdle, and ten yards to a two-inch black line. After reaching the end line, the subject turned back toward the start, ran ten yards to hurdle number three, and then ran ten additional yards to the finish line.

The electric timing device used for scoring was accurate to the nearest 1/100 sec. The clock was started by clapping two boards together. The

boards were lined with sheet copper to which electric wires were attached. As the sheets of copper came together, the clock started and continued until the runner broke the electric circuit which was controlled by a rod, waist high, across the finish line. This rod was attached to a hinge which controlled a micro switch. When the rod was moved on the hinge, the micro switch cut the current and stopped the clock. Time was recorded to the nearest 1/100 sec. Each day's total score included the average of five timed trials following the usual warm-up and teaching procedures.

Forty college men were used as subjects. Each subject was given a pretest in each skill, which consisted of one day's total score as outlined above. Two matched groups were then formed on the basis of scoring on the pretests. The total number of scores were arranged from highest to lowest, after which individual cases of high and low scores were placed in two groups. Twenty men formed the experimental group and proceeded through the experiment two days per week for three weeks on each skill, spending two alternate days each week in learning swimming. Mondays and Wednesdays were used for learning the skills, and Tuesdays and Thursdays were devoted to swimming. Each swimming session was one hour, and consisted of practice at the level of late beginning and early intermediate American Red Cross swimming instruction. A total of six weeks was necessary to complete the experiment. The 20 subjects in the control group proceeded through the experiment in the same manner, with the exception that they received no swimming instruction. One half of each group learned the volleyball skill first and one half the hurdle skill first, so that counter-balancing could be used as a control.

Each skill was filmed in slow motion with good performers as subjects. The filmed skills were made into loopfilm and used for teaching purposes. This made all teaching uniform and aided in controlling the experiment. The important teaching principles used in each skill were written on a card and read to each subject along with the viewing of the film.

Data were derived from two scoring techniques: (1) The use of sixth day scores (a measure of final learning), and (2) the difference between the first and last day scores (a measure of improvement). These techniques of measuring motor learning have been used successfully by others (9, 10, 2), although different methods such as Henry's (3) have great merit. It is recognized that the techniques selected are not the only measures of motor learning, but they seem to be objective devices which indicate achievement of some kind. Statistical comparisons of the two groups were made by checking the significance of the difference between means (5 *p. 112-114*).

Results and Conclusions

The evaluation of the significance of the difference between the observed means of the two groups is shown in Table 1. The means of each group, regardless of scoring technique used, were very nearly the same. In all cases

it was found that P > .05, which means that the differences were not found to be significant.

TABLE 1
Means and T-Ratio for the High Hurdle and Volleyball Skills

Group Comparison	Means	D	S_d	"t" ratio	
		High Hurdles			
Final Scores		.22	.17	1.29	P>.05
Experimental	9.81				
Control	10.03				
Difference between first and last scores		.06	.10	.60	P>.05
Experimental	.44				
Control	.38				
		Volleyball Tap for Accuracy			
Final Scores		1.00	2.78	.35	P>.05
Experimental	192.00				
Control	191.00				
Difference between first and last scores		2.00	10.40	.19	P>.05
Experimental	44.60				
Control	46.60				

The answer to the first question, "Does swimming during the learning of gross motor skills result in negative transfer of learning?" seems clear. Under the conditions of the experiment, swimming had neither a favorable nor unfavorable effect on volleyball tapping for accuracy and on running the high hurdles.

If swimming were to soften, lengthen, and stretch muscles or supply movement patterns which interfere with the learning or performance of other patterns of movement, it seems that these conditions would result in positive or negative learning. Since this did not happen in the two selected skills, it can be implied that swimming does not have any lasting effect on the learning of other skills. If it does affect a person's structure and function, it seems to be of short duration. It should be remembered that water temperature is considerably below body temperature and that energy is taken from the body just by being in the water. This in itself does change bodily function, which could interfere with learning during the time of interference. Since this type of fatigue is of comparatively short duration, it appears that a night's rest restores the body's ability to learn skills and perform well on the following day.

If these implications and findings are not misleading, observations seem to indicate that the learning of swimming has no effect on the learning and performance of gross motor skills with dissimilar patterns and movements.

However, more extensive experimentation would have to be completed to be certain of the effect on other skills not included in the experiment.

The answer to the second question in the introduction was not a part of this study, but one item for speculation seems worthy of mention. If swimming and the learning of other skills with dissimilar patterns and movements occur during the same day and there is negative transfer of learning, it would appear that the cause might be the expenditure of too much energy in swimming, and negative effects could be attributed to fatigue.

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(Submitted 4/4/57)

Compensation Practices and Extracurricular Responsibilities of Women High School Physical Education Teachers

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Abstract

A survey of women high school physical education teachers was conducted for the primary purpose of determining compensation practices for extracurricular responsibilities, and secondarily to examine the nature of the offerings. Completed checklists were received from 445 teachers representing schools from every state in the United States.

Major findings reveal: (1) no compensation in 51.2% of the schools, extra pay 39.6%, reduced load 6.7%, pay and reduced load 2.3%; (2) the three most highly paid activities are interscholastics, Girls Athletic Association, and intramurals; (3) teachers devote a median of six hours a week to extracurricular duties—a large majority supervise Girls Athletic Association, intramurals, and special interest groups; better than 50% conduct cheerleaders groups.

THE PRIMARY purpose of this study was to examine the practices in compensating women high school physical education teachers for their extracurricular responsibilities. A secondary purpose was to examine the nature of the extracurricular program relative to such factors as the amount of time spent by the physical education teacher, the types of activities for which she is responsible, and the specific extracurricular program offerings in physical education.

The study was conducted by the Research Committee[1] of the National Section for Girls and Women's Sports, AAHPER.

Procedures

A checklist was developed to be used for surveying teachers relative to their extracurricular responsibilities. It was decided that a satisfactory method for reaching large numbers of teachers in various sections of the country with reasonable assurance of receiving completed returns, was to distribute the checklist at selected meetings of the National and District Conventions of the American Association for Health, Physical Education, and Recreation. Key members of the National Section for Girls and Women's Sports who were to be in attendance at the various conventions were asked to be responsible for giving out and collecting the checklists at appropriate

[1]Other members of the Committee are Dr. Katherine Fox, University of Washington; Dr. Jane Mott, Smith College; and Dr. Olive Young, University of Illinois.

meetings. Approximately 250 checklists were sent to the National and each of the District Conventions,[2] and 50 to the Indiana State Convention. The returns from the conventions were quite disappointing and far below what had been anticipated, since only 229 completed checklists were received from this source.

In order to supplement these returns, checklists were sent to 304 women high school physical education teachers, members of the American Association for Health, Physical Education, and Recreation, who were selected at random from the membership. From this source, 18 checklists were returned from the post office because of changes of address, and 183 were returned from respondents, of which 170 were properly filled out and usable. This brought the total of completed checklists to 399. In subsequent tabulations, it was noted that there were some states from which returns were low or no returns at all had been received. It was decided, therefore, to sample these states in order to improve the national coverage. An atlas and table of random numbers were used, and 107 towns and cities were selected at random from these states. Checklists were sent to the Women's High School Physical Education Teacher in the selected towns and cities. Fifty-nine checklists were returned, of which 55 were usable. A careful check, preliminary to mailing, was made to insure that no duplications of schools occurred as a result of the various sampling procedures. With these last returns, a total of 445 checklists were available for analysis, with at least one return from every state and the District of Columbia.

Analysis of Results

In the analysis of results that follows, it should be borne in mind that all interpretations must necessarily be limited by the nature of the sampling procedures used. While no known bias was introduced, the sampling procedures offer no guarantee that none is present.

Two factors were given consideration in reporting the data.[3] It was thought that city size and general area of the country might be related to policies and practices followed. For purposes of delimiting areas of the country, the districts[4] as established by the American Association for Health, Physical Education, and Recreation were used.

COMPENSATION POLICIES

Table 1 presents the number and per cent of schools following each compensation policy, according to three city sizes and for consolidated systems.

The figures in Table 1 indicate that city size appears to have very little relation to the compensation practice followed. In all but cities over 100,000

[2]The Southern District Convention was excepted, since it was held too early to be included in the study.

[3]Grateful acknowledgment is hereby made to Shirley Wood and her assistant, Winifred Cook, for their valuable contributions in tabulations and calculations.

[4]See Appendix, p. 394, for states arranged according to districts, and the number of returns received from each state.

population, slightly more than half the schools give no compensation for extracurricular responsibilities. In the cities over 100,000, slightly less than half give no compensation. Among schools that give compensation in some form, the practice of giving extra pay is by far the most prevalent, followed by load reduction, and in a very small proportion of cases, both extra pay and load reduction are provided.

There is a somewhat smaller per cent of schools in the under 25,000 classification that reward teachers by reducing the teaching load than exists among the other schools. The practices reported for the consolidated school systems correspond very closely to those reported for schools in the 25,000 to 100,000 classification.

TABLE 1

Number and Per Cent of High Schools Following Various Practices In Compensating Women Physical Education Teachers for Extracurricular Responsibilities, By City Size

City Size	Policy										Total	
	No compensation		Reduced Load		Extra Pay		Reduced Load and Extra Pay		Other*			
	N	%	N	%	N	%	N	%	N	%	N	%
Under 25,000	86	52.4	8	4.9	69	42.1			1	0.6	164	36.8
25,000 to 100,000	58	51.8	9	8.0	41	36.6	4	3.6			112	25.2
Over 100,000	40	47.1	7	8.2	36	42.4	2	2.3			85	19.1
Consolidated School	44	52.4	6	7.1	30	35.7	4	4.8			84	18.9
Total	228	51.2	30	6.7	176	39.6	10	2.3	1	0.2	445	100.0

*One school provided a merit system, by which the teacher's extracurricular contributions were given consideration in awarding salary increases.

Table 2 presents the number and per cent of schools following each compensation policy, according to the six districts.

The Eastern, Midwest, Central, and Southern Districts are quite similar in their practices, with the Southwest and Northwest Districts exhibiting rather

TABLE 2

Number and Per Cent of High Schools Following Various Practices In Compensating Women Physical Education Teachers for Extracurricular Responsibilities, By District

District	Policy										Total	
	No compensation		Reduced Load		Extra Pay		Reduced Load and Extra Pay		Other*			
	N	%	N	%	N	%	N	%	N	%	N	%
Eastern	62	54.3	6	5.3	44	38.6	2	1.8			114	25.6
Midwest	82	51.9	18	11.4	54	34.2	4	2.5			158	35.5
Central	29	48.3	3	5.0	27	45.0			1	1.7	60	13.5
Southern	20	51.3	1	2.6	18	46.1					39	8.8
Northwest	12	32.4			22	59.5	3	8.1			37	8.3
Southwest	23	62.2	2	5.4	11	29.7	1	2.7			37	8.3
Total	228	51.2	30	6.7	176	39.6	10	2.3	1	0.2	445	100.0

*One school provided a merit system, by which the teacher's extracurricular contributions were given consideration in awarding salary increases.

distinct departures from the general pattern. There is a rather clear majority (62.2%) of schools in the Southwest and a rather clear minority (32.4%) of schools in the Northwest which give no compensation for extracurricular responsibilities. In the Southwest, only 29.7 per cent of the schools give extra pay, 5.4 per cent give a reduced load, and 2.7 per cent give both a reduced load and extra pay. In the Northwest, 59.5 per cent give extra pay and 8.1 per cent give both extra pay and a reduced load. An examination of these figures by states revealed that in the Northwest the figures are being dominated by the State of Washington where only 2 out of 22 (9.1%) schools fail to provide compensation. In each of the other three states of the Northwest, at least 60 per cent of the schools fail to give compensation, making their results very similar to those reported in the Southwest.

Other states which showed major departures from their district average and from which reasonably large returns were received are as follows. In the Eastern District, 100 per cent of the schools reporting from Maryland and 65.4 per cent from New York give no compensation, while in Pennsylvania only 25 per cent fail to provide compensation. In the Midwest District, 68.2 per cent of the schools from Ohio give no compensation while in Michigan only 30.4 per cent are not providing compensation. In the Central District, 61.1 per cent of the Colorado schools report no compensation.

There is more of a tendency for schools in the Midwest District to compensate teachers through a reduction in load than in the other districts. The Northwest schools provided both a reduction in load and extra pay more often than the schools in any other district.

When considering totals, without regard for either city size or district, reference to either Table 1 or 2 reveals that the most prevalent practice in the schools sampled is to provide no compensation, with 228 (51.2%) of the 445 schools following this practice. The remaining 48.8 per cent of the schools provide compensation in some form. Among the schools with a compensation policy for extracurricular responsibilities, 39.6 per cent give extra pay, 6.7 per cent reduce the teacher's load, 2.3 per cent give both extra pay and a reduced load, and .2 per cent follow another practice.

Compensation through load reduction was reported in 40 of the 445 schools surveyed. In 30 of these schools, load reduction was the sole compensation and in 10 schools it was combined with extra pay. In the 30 schools with load reduction only, the amount of reduction was not reported in 12 schools and in the remaining 18 the mean reduction was 5 hours a week with a range of from 2 to 10 hours. In the 10 schools that combined load reduction with extra pay, the amount of reduction was not reported in 3 schools and in the remaining 7 the mean reduction was 5 hours a week with a range of from 1 to 8 hours.

AVERAGE AMOUNTS OF EXTRA PAY

Table 3 presents the average amounts of extra pay given women high school physical education teachers for supervising various activities in the extracur-

TABLE 3

Average Amounts of Pay Given Women High School Physical Education Teachers for Supervising Various Extracurricular Activities

Extracurricular Activity	Payment per Year				Payment per Hour				Payment per Event			
	No.	Mean	Median	Range	No.	Mean	Median	Range	No.	Mean	Median	Range
Girls Athletic Association	42	184.05	150	25-693	7	3.13	3.33	2.00-3.60				
Intramural Program	37	175.61	150	25-350	7	2.25	2.50	1.50-3.50				
Interscholastic Program, All Activities	6	247.50	275	50-400	1	3.50	3.50					
Interscholastic Program, Single Activity	62	156.66	100	75-500	7	3.50	3.50					
Girls Athletic Ass'n. and Intramurals	12	309.42	200	100-1028								
Girls Athletic Ass'n. and Interscholastic Program	1	275.00	275									
Girls Athletic Ass'n., Intramurals, and Interscholastic Program	6	208.33	200	100-400								
Intramural and Interscholastic Programs	5	236.00	200	180-300								
Cheerleaders Group	22	104.05	100	25-200					1	5.00	5.00	
Girls Athletic Ass'n. and Cheerleaders	2	225.00	225	150-300								
Chaperone Boys Games	1	100.00	100		2	1.25	1.25	1.00-1.50	4	3.63	3.75	3.00-4.00
Chaperone Boys Games & Cheerleaders	2	122.00	122	100-144								
Chaperone Social Activities	2	125.00	125	50-200	3	1.98	1.94	1.00-3.00	2	4.25	4.25	3.50-5.00
All Extracurircular Activities	16	263.75	220	150-600								
Special Interest Groups	5	200.00	100	100-500	1	3.60	3.60		2	8.00	8.00	2.00-14.00

ricular program. Two averages and the range are given in order to provide as clear a picture as possible.

Examination of the figures in Table 3 reveals that the mean and median rarely coincide, which indicates the presence of skewed distributions; hence, the median is probably the more representative of the two averages and it will be used in subsequent discussions.

In attempting to discern the most highly paid or most poorly paid activities, the picture is somewhat obscured by the fact that in many schools extra pay is given for combinations of activities rather than for single activities. However, an examination of the median pay for the various activities indicates that in any case where an interscholastic program is involved the average is at least $200. What appears to be the exception to this is under the category of "Interscholastic Program, Single Activity." It should be pointed out that this compilation does not represent 62 different schools offering single activities in the interschool program, but in many cases two or more interschool activities are offered in the same school, each activity with its own pay scale. It would therefore appear that the interscholastic extracurricular activities are the ones for which the largest amount of extra pay is given, on the average. The next most highly paid activities are the Girls Athletic Association and the intramural program, followed by various forms of chaperoning, supervising special interest groups, and leading cheerleader groups. Special interest groups include drill team, marching unit, fencing club, usher's club, twirling club, and sports- and play-days. The drill team, which in one school was subsidized to the extent of $500 per year, was the most highly paid of the special interest groups on the annual basis, and sports- and play-days which in one school were paid for at the rate of $14 per day were the most highly paid on the event basis.

Table 4 presents a breakdown of the specific activities in the interscholastic athletic program and the average amounts of pay given for the various activities.

TABLE 4

Average Amounts of Extra Pay Given Women High School Physical Education Teachers for Supervising Specific Activities In The Interscholastic Program

Activity	Payment per Year				Payment per Hour[1]	
	Number	Mean	Median	Range	Number	Amount
Basketball	21	182.19	175	76-500	1	3.50
Tennis	14	140.57	100	50-300	1	3.50
Field Hockey	13	159.62	175	100-300		
Softball	6	126.67	105	50-200	1	3.50
Swimming	4	107.00	89	75-175	1	3.50
Volleyball	1	378.00	378		1	3.50
Bowling	1	100.00	100		1	3.50
Archery	1	78.00	78			
Skiing	1	150.00	150			
Badminton					1	3.50

[1]This represents the practice of a single school.

It can be seen from reference to Table 4 that basketball is the activity for which extra pay is most frequently given and along with field hockey is the most highly paid. Tennis is the leader among the individual and dual sports both in frequency and amount of extra pay.

It appears from Table 4 that the conduct of team sports in the interscholastic program is more likely to be compensated with extra pay than is the conduct of individual sports, and this is true when the sole consideration is the actual number of schools which provide extra pay for the activity. However, when the ratio between the number of schools compensating the activity and the number of schools providing the activity is given consideration, a somewhat different picture emerges. With this proportionate comparison, it is found that extra pay is provided for team sports 12.9 per cent of the time and for individual sports 19.7 per cent of the time. Swimming and tennis are the leaders in this comparison, extra pay being given for their supervision, 25.0 per cent and 24.6 per cent of the time respectively. Field hockey and basketball follow, with extra pay being provided 22.4 per cent and 17.4 per cent of the time respectively.

The following tables and discussions are included for the purpose of providing some insight into the extent and nature of the extracurricular responsibilities of women high school physical education teachers, regardless of compensation practices.

AVERAGE HOURS SPENT

Table 5 presents the average hours per week that the teachers devote to extracurricular duties, according to the size of city in which they teach.

TABLE 5

Average Hours Per Week Women High School Physical Education Teachers Devote to Supervisory Extracurricular Activities, by City Size

City Size	Number	Mean	Median	Range
Under 25,000	154	7.2	6	0-20
25,000 to 100,000	99	6.8	6	0-24
Over 100,000	81	5.7	5	0-15
Consolidated Schools	76	6.5	6	0-15
Total	410	6.7	6	0-24

Since 35 of the respondents failed to give the necessary information, the figures on average hours spent are based on the replies from 410 teachers.

The figures in Table 5 suggest the presence of an inverse relationship between city size and the number of hours spent in extracurricular duties. The arithmetic average decreases consistently with the increase in city size, and the median number of hours shifts from six in the two smaller city sizes to five in city sizes of over 100,000. The consolidated school figures correspond very closely to those reported for schools in the 25,000 to 100,000 classification.

Table 6 presents the average hours per week that the teachers devote to extracurricular duties according to the district in which they teach.

TABLE 6

Average Hours Per Week Women High School Physical Education Teachers Devote to Supervising Extracurricular Activities, by Districts

District	Number	Mean	Median	Range
Eastern	104	7.6	7	0-24
Midwest	147	6.4	5	0-18
Central	49	5.2	5	0-14
Southern	41	7.8	8	0-15
Northwest	36	6.8	6	2-16
Southwest	33	5.8	5	2-13
Total	410	6.7	6	0-24

It may be seen from the figures in Table 6 that there are differences in the average hours physical education teachers spend in supervising extracurricular activities in the various districts. The Southern and the Eastern District teachers spend the most time followed by the Northwest, Midwest, Southwest, and Central in that order.

Without regard for city size or district, it may be seen from Table 5 or Table 6 that women physical education teachers spend a median of six hours a week in extracurricular activities, with some teachers having no responsibility for this kind of program and others devoting as much as 24 hours a week to it.

NATURE OF EXTRACURRICULAR OFFERINGS

The figures in Table 7 provide information on the number and per cent of high schools which offer various types of extracurricular activities for which the woman physical education teacher is expected to assume responsibility, according to different city sizes.

Reference to Table 7 reveals that there are some similarities and some differences in extracurricular duties according to the city size classification. The Girls Athletic Association is a featured activity in all the school programs, but there is a distinctly smaller possibility that the woman physical education teacher will have this as a responsibility in schools in cities over 100,000 in population as compared to the schools in the other size classifications.

The intramural program is another featured extracurricular activity and city size makes little difference in the frequency of its offering; however, in the consolidated schools it is offered in the program somewhat less frequently than in the other schools.

The interscholastic sports program, under the control of the woman physical education teacher, is not highly featured in any of the schools as grouped in the four categories, although it is included somewhat more frequently in schools where the city population is more than 100,000 and in consolidated schools, than it is in the schools of the other two classifications.

TABLE 7

Number and Per Cent[1] of High Schools Offering Various Extracurricular Activities for Which the Woman Physical Education Teacher is Responsible, by City Size

City Size	Extracurricular Activities												Number of Schools
	Girls Athletic Association		Intramural Program		Interscholastic Program		Sports and Special Interest Clubs		Chaperone Boys Games		Chaperone or Supervise Social Activities		
	N	%	N	%	N	%	N	%	N	%	N	%	
Under 25,000	126	76.8	118	72.0	63	38.4	123	75.0	53	32.3	96	58.5	164
25,000 to 100,000	83	74.1	85	75.9	38	33.9	69	61.6	34	30.4	60	53.6	112
Over 100,000	49	57.6	61	71.8	37	43.5	45	52.9	12	14.1	29	34.1	85
Consolidated Schools	63	75.0	51	60.7	35	41.7	56	66.7	25	29.8	50	59.5	84
Total	321	72.1	315	70.8	173	38.9	293	65.8	124	27.9	235	52.8	445

[1]Per cents total more than 100 across the rows since categories are not mutually exclusive.

Sports and special interest clubs are among the top three kinds of activities for which women physical education teachers have responsibility in all of the city size groupings. However, there does appear to be an inverse or negative relationship between schools according to city size and the frequency with which sports and special interest clubs are included in the extracurricular program.

The responsibility for chaperoning various activities is found among the schools in all classifications, although it is quite evident that there is a much smaller probability that the woman physical education teacher will have such duties in schools over 100,000.

Table 8 presents information relative to the number and per cent of high schools which offer various types of extracurricular activities for which the woman physical education teacher is expected to assume responsibility, according to the various Districts.

The figures in Table 8 indicate that in the various districts there are considerable differences in the extracurricular programs which are sponsored by women physical education teachers. There is little doubt that there is a difference in the emphasis on the Girls Athletic Association in the schools of the Midwest and Southwest Districts as opposed to the schools of the Eastern and Southern Districts. The observed per cents indicate that more than 90 per cent of the schools in the first two mentioned districts include the Girls Athletic Association in their extracurricular programs, while less than 50 per cent of the latter two included this organization.

The discrepancies in the per cents of schools providing an intramural program are not marked, although the Eastern District appears to be the leader in providing this type of program. A clear majority (60% or over) of the schools in all of the districts sponsor an intramural program.

The interscholastic sports program, under the direction of the woman physical education teacher, is another extracurricular activity in which there is a pronounced disparity among the districts. This type of program is offered with the greatest frequency in the schools of the Eastern District (65.8%) and least often in the schools of the Central District (16.7%). Neither the Midwest nor the Southwest schools give any great emphasis to the interscholastic program, while approximately half of the Southern and Northwest District schools sponsor such a program.

Sports and special interest clubs play a prominent role in the extracurricular programs of the schools of all of the districts with no particularly outstanding discrepancies noted.

The woman high school physical education teacher has some considerable chaperoning responsibility in all of the districts. Chaperoning of boys games is a service rendered by the teacher in approximately one-fourth of the schools in all the districts except in the Central where this apparently is infrequently requested. Chaperoning of social activities is part of the duty in approximately half of the schools of all districts except the Southwest in which this service was reported in 73 per cent of the schools.

TABLE 8

Number and Per Cent[1] of High Schools Offering Various Extracurricular Activities for Which the Woman Physical Education Teacher is Resonsible, by District

District	Extracurricular Activities												Number of Schools
	Girls Athletic Association		Intramural Program		Interscholastic Program		Sports and Special Interest Clubs		Chaperone Boys Games		Chaperone or Supervise Social Activities		
	N	%	N	%	N	%	N	%	N	%	N	%	
Eastern	54	47.4	96	84.2	75	65.8	76	66.7	30	26.3	53	46.5	114
Midwest	143	90.5	103	65.2	40	25.3	105	66.5	44	27.8	81	51.3	158
Central	45	75.0	36	60.0	10	16.7	32	53.3	1	1.7	31	51.7	60
Southern	15	38.5	28	71.8	21	53.8	28	71.8	15	38.5	23	59.0	39
Northwest	30	81.1	28	75.7	18	48.6	27	73.0	8	21.6	20	54.1	37
Southwest	34	91.9	24	64.9	9	24.3	25	67.6	9	24.3	27	73.0	37
Total	321	72.1	315	70.8	173	39.9	293	65.8	124	27.9	235	52.8	445

[1]Per cents total more than 100 across the rows, since categories are not mutually exclusive.

The major extracurricular emphasis in four of the Districts, the Southwest, Midwest, Northwest, and Central is the Girls Athletic Association; the major emphasis in the Eastern District is the intramural program; and in the Southern District there is an equal emphasis on the intramural program and sports and special interest groups.

With no consideration for either city size or district, the Girls Athletic Association (72.1%) leads all other kinds of extracurricular responsibilities in the schools studied, followed by the intramural program, (70.8%), sports and special interest groups, (65.8%), chaperoning or supervising social activities, (52.8%), interscholastic program, (38.9%), and chaperoning boys games, (27.9%).

In order to reveal some of the special competencies the woman physical education teacher might be expected to have relative to the extracurricular program, the specific offerings in the interscholastic sports programs and the nature of activities classified under special interest groups are presented.

The specific offerings in the interscholastic programs of the various districts are given in Table 9.

The three interschool activities offered most frequently in the schools of the Eastern District are basketball, softball, and field hockey. The Eastern District leads all the other districts in per cent of times each of these activities is offered and also leads the other districts in sponsoring bowling as an interschool activity. While the preponderance of the emphasis is on providing interschool play in the team sports, the Eastern District schools have a diversity of offerings in the interscholastic sports program.

The Midwest, Central, and Southern District schools are alike in that all offer basketball, volleyball, and softball most frequently. However, the Southern schools differ from those in the other two districts in that the emphasis on basketball far surpasses the emphasis on volleyball and softball. The Midwest District has a slight lead on the other districts in the per cent of schools providing archery and sports and playdays as interschool activities. The schools of the Midwest, like those of the Eastern, have a diversity of offerings.

The Central District, which reference to Table 8 will reveal has the smallest per cent of schools participating in interschool play, is, nevertheless, the leader in providing such opportunities in swimming and golf.

The Southern District schools place a heavier emphasis on team game offerings than on individual and dual type games.

The schools of the Northwest and Southwest Districts are the only ones which do not place the major stress on team games for interschool play. Tennis is by far the most popular interschool activity in the Northwest District, and it appears to have equal popularity with basketball and volleyball in the Southwest. The Northwest District leads all others in the per cent of times tennis is offered as an interschool activity and the Southwest District leads all the others in providing an interscholastic program in volleyball and badminton.

TABLE 9

Numbers and Per Cent[1] of Times Specific Interschool Activities are Offered in Those Schools which Provide an Interscholastic Program, by Districts

District	Activity																								Number of Schools
	Basketball		Softball		Volleyball		Field Hockey		Tennis		Badminton		Swimming		Bowling		Golf		Archery		Sports and Play Days			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Eastern	66	88.0	54	72.0	36	48.0	40	53.3	21	28.0	15	20.0	6	8.0	11	14.7	3	4.0	7	9.3	2	2.7			75
Midwest	22	55.0	15	37.5	17	42.5	10	25.0	13	32.5	3	7.5	6	15.0	2	5.0	6	15.0	4	10.0	5	12.5			40
Central	5	50.0	4	40.0	5	50.0	3	30.0	3	30.0	2	20.0	2	20.0			3	30.0			1	10.0			10
Southern	17	81.0	5	23.8	8	38.1	4	19.0	4	19.0			1	4.8	1	4.8			1	4.8	1	4.8			21
Northwest	6	33.3	4	22.2	5	27.8			11	61.1	4	22.2									2	11.1			9
Southwest	5	55.6	3	33.3	5	55.6	1	11.1	5	55.6	3	33.3	1	11.1	1	11.1	1	11.1			1	11.1			18
Total	121	69.9	85	49.1	76	43.9	58	33.5	57	32.9	27	15.6	16	9.2	15	8.7	13	7.5	12	6.9	12	6.9			173

[1]Per cents total more than 100 across the rows, since categories are not mutually exclusive.

Considering all of the schools of the combined districts, basketball is found to be the activity offered most frequently (69.9%) in the interschool program, followed by softball (49.1%), and volleyball (43.9%). Tennis is the individual-dual type sport found most frequently (32.9%).

Table 10 presents the breakdown of figures on sports and special interest groups supervised by women high school physical education teachers.

TABLE 10

Number and Per Cent of Schools in which the Woman High School Physical Education Teacher is Responsible for Supervising Certain Sports and Special Interest Groups

Activity	Number	Per Cent
Cheerleaders	238	53.5
Pep Club	28	6.3
Academic Clubs	27	6.1
School Programs	21	4.7
Dance Group	20	4.5
Drill Club	18	4.0
Class Sponsor	16	3.6
Sports Clubs	16	3.6
Majorettes and Twirlers	11	2.4
Swim Club	8	1.8
Leaders Club	6	1.3

The major activity in this category is clearly the supervision or conduct of cheerleader groups. The physical education teacher may anticipate that there is about an even chance she will find herself assigned to assume the duties involved in organizing and training cheerleaders. That this responsibility is quite universal was revealed by an examination of the checklist results from the various states. In all but two states, at least 25 per cent of the teachers report that this is an extracurricular responsibility requested of them. Nebraska, with reports from three schools, and Tennessee, with reports from six schools, did not mention the conduct of cheerleaders groups as a responsibility.

Other special supervising responsibilities, which in addition to those presented in Table 10 were mentioned at least two or three times, were marching or drill groups, yearbook adviser, and drum and bugle corps.

Summary of Major Findings

1. Slightly more than one half (51.2%) of the 445 schools surveyed provide no compensation for the extracurricular responsibilities assumed by the woman high school physical education teacher. Among the schools that do provide compensation 39.6 per cent give extra pay, 6.7 per cent reduce the teaching load, 2.3 per cent give both extra pay and a reduced load, and .2 per cent follow some other practice.

City size makes little difference in the practice followed, but district does make some difference.

2. The type of extracurricular responsibility for which the largest amount of extra pay is provided, on the average, is the interschool sports program. The next most highly paid responsibilities, in order, are the Girls Athletic Association, the intramural program, various forms of chaperoning, special interest groups, and cheerleader groups.

Among the activities in the interscholastic sports program, basketball leads all others in frequency of extra pay and, with field hockey, is the most highly paid. Tennis is the most outstanding of the individual and dual sports in both frequency and amount of extra pay.

3. The women high school physical education teachers surveyed devote a median of six hours a week to their extracurricular duties. Teachers in cities of over 100,000 population and in the Central and Southwest Districts spend somewhat less time in such duties than do the teachers in smaller cities and other districts.

4. The type of extracurricular activity for which the women physical education teachers are most often responsible is the Girls Athletic Association. Among the teachers surveyed, 72.1 per cent reported this activity. The responsibilities occurring next, in order of their frequency, are the intramural program (70.8%), sports and special interest groups (65.8%), chaperoning social activities (52.8%), the interscholastic sports program (38.9%), and chaperoning boys games (27.9%). Both city size and district make some difference in the extracurricular program emphasis.

5. In those high schools which provide an interscholastic sports program, basketball is offered in 69.9 per cent of the schools, softball in 49.1 per cent, volleyball in 43.9 per cent and field hockey in 33.5 per cent. Tennis is the leading individual-dual type sport, being offered in 32.9 per cent of the schools. There are marked disparities in the interschool program emphasis of the various districts. Basketball is heavily stressed in the Eastern and Southern Districts. The Eastern District also stresses softball and field hockey much more than any of the other districts. The Northwest and Southwest Districts are particularly prominent in providing interschool play in tennis, and the Central District leads all others in offering swimming and golf.

6. The woman high school physical education teacher may on occasion be called on to supervise a variety of activities in the extracurricular program, but there is a very good chance she will have to be responsible for cheerleader groups since 238 (53.5%) of the schools surveyed request such a service.

It should be kept in mind that all findings are relevant only to the groups surveyed and are not necessarily representative of all high school women physical education teachers. While no bias has been intentionally introduced in the selection of the sample, the sampling procedures used provide no guarantee that none is present.

APPENDIX

States Arranged According to Districts with Number of Responses from Each State

Eastern District	N	Southern District	N
Connecticut	10	Alabama	3
Delaware	5	Arkansas	1
Maine	2	Florida	4
Maryland	17	Georgia	3
Massachusetts	9	Kentucky	1
New Hampshire	4	Louisiana	2
New Jersey	15	Mississippi	2
New York	26	North Carolina	1
Rhode Island	5	Oklahoma	2
Pennsylvania	16	South Carolina	2
Vermont	4	Tennessee	6
Washington, D. C.	1	Texas	7
		Virginia	5
Midwest District	**N**	**Southwest District**	**N**
Illinois	64	Arizona	5
Indiana	36	California	21
Michigan	23	Nevada	3
Ohio	22	New Mexico	5
West Virginia	4	Utah	3
Wisconsin	9		
Central District	**N**	**Northwest District**	**N**
Colorado	18	Idaho	4
Iowa	5	Oregon	6
Kansas	3	Montana	5
Minnesota	9	Washington	22
Missouri	9		
Nebraska	3		
North Dakota	4		
South Dakota	4		
Wyoming	5		

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Laterality in Swimming and Its Relationship to Dominance of Hand, Eye, and Foot

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Abstract

This study explores factors of lateral dominance in relation to movement patterns in the crawl and side strokes. The subjects were first and second year college women. Eyedness, footedness, handedness, and sidedness in the two swimming strokes were investigated. The data indicate that swimmers who breathe to the right in the crawl tend to swim on the left side in the side stroke; similarly, swimmers who breathe to the left tend to swim the side stroke on the right side. Dominance of eye, hand, or foot was not established as significant in the choice of side for swimming.

LATERAL DOMINANCE should be of great interest to all teachers of physical education. Of all educators, they have the best opportunity for significant observations in a wide variety of situations yet they have made few contributions to the scientific literature dealing with dominance. The investigators have observed that both right- and left-sided swimmers (side stroke) and right and left breathers (crawl) may be found in almost any group. They have also observed that though many right-sided swimmers in the sidestroke breathe to the left in the crawl and *vice versa* it is not uncommon to see a right-sided swimmer who breathes right in the crawl or a left-sided swimmer who breathes to the left. Instructors have no reliable criteria to use in helping students to make a choice for the development of these strokes and usually leave the matter to chance, natural inclination, or imitation.

Similarly, in other sports activities right and left choices are usually unguided except for the influences exerted by our right-handed culture. Psychologists have demonstrated an association of laterality dominance with speech, writing, and reading disabilities and have observed an apparent relationship to motor coordination and personality adjustments. It is possible that the learning of motor skills may be related to dominance factors and that understanding of the relationship may lead to better teaching of motor skills.

It is the purpose of this study to discover the relationship, if any, between directional or sidedness choices as exhibited by swimmers in the side and

crawl strokes and dominance of hand, eye, and/or foot. To further this purpose, it was necessary (a) to discover the incidence and completeness of lateral dominance of the subjects in non-swimming activities; (b) to discover the sidedness choices of subjects in swimming and their relationships in the crawl and side-stroke; and (c) to study the relationship of sidedness in swimming to lateral dominance (b to a) as exhibited by the subjects.

Review of Literature

Review of the literature has revealed no studies in the laterality of swimming. Laterality has been studied extensively as related to the preference for right or left hand and for right or left eye and to a lesser extent in the preference for right or left foot. Giesecke (11) hypothesized that "handedness may be an aspect of sidedness" and others have sought to establish this hypothesis in relating the dominance of eye and hand and hand and foot. Ojemann (19), Johnson and Dake (17), Irwin (15), and others have found variation in the pattern of right and left handedness when bimanual rather than unimanual activities are used. Tuttle and Travis (25) sought to relate handedness to precedence of movement in homologous structures but concluded that the lead of the two structures involved varied more with the instructions given and the task involved than with hand dominance. In reviewing the literature, both Downey (8) and Martin (18) support the assumption that lateral dominance is evidence of cerebral hemisphere development and control and that it is manifested in a complex of sidedness preferences in which handedness is the most obvious and clearly demonstrated. Blau (5) and Hildreth (13) refute the theory of cerebral dominance as a *cause* of laterality. Hildreth (13) cites much evidence to support the theory of special training as the causal factor.

Although psychologists continue to debate the innate or acquired bases of lateral dominance, right-handedness has been definitely established as occurring in the large majority of adults; the tendency to be right-handed increases with age through childhood, and hand preference is seldom well established under two years of age. Downey (8) states that 64-85 per cent of right-handed people will also be right-eyed but points out that eye-dominance will vary in degree. All investigators have reported a higher incidence of dextrality among girls and women than among boys and men. Hildreth (13) found that college students show the lowest percentage of left-handedness of all populations. Since left-eyedness is more common than left-handedness, mixed eye-hand dominance tends to increase with age, and mixed eye-hand dominance is more common among sinistrals than among dextrals, it appears that training and cultural influences may overcome any tendency of a left-eyed individual to develop left-handedness.

The literature includes many studies of the relationship of lateral dominance to speech, reading ability, writing, mental retardation, and personality maladjustments. Although evidence is by no means conclusive for generalizations, Downey's (8) position seems typical, "It is concluded that mixed domi-

nance may accompany defective development or instability of the central nervous system." He believes mixed dominance to be a handicap for highly integrated functions such as language but a handicap which can be overcome. Martin (18) similarly concluded that much sinistrality is a manifestation of slow learning. Hildreth (13), although commenting that many sinistrals are highly intelligent, cites evidence to show that the incidence of left-handedness is twice as high among the mentally retarded as for those of normal intelligence and that among the mentally defective the incidence is three times that of the normal. She states that confusion in dominance retards learning and stresses the importance of early training for hand dominance—preferably for the right hand but for the left when there is perseverance and insistence in the choice of this hand.

Only four studies have been found in which the investigators have attempted to study lateral dominance in large movements of the body, such as those practiced in physical education. Vogel (26) found that left-handers varied in the use of the hands when batting and throwing while both right-handers and the ambidextrous used the right hand consistently. In studying the use of the dominant hand and foot in a series of athletic skills Irwin (15) found much greater consistency in the use of the hand than of the foot; the sinistrals remained constant in the use of the left hand while the right-handed and the ambidextrous tended to shift from right to left. Irwin (15) suggests that more attention should be paid to these "shifters," especially in the earlier years, thereby preventing later difficulties caused by mixed or incomplete dominance.

Roth (22), in the study of hand-eye dominance related to motor ability, found variation with different dominance combinations. Left-handed right-eyed persons exhibited superiority; left-handed left-eyed persons were inferior; right-handed right-eyed persons were second in motor ability; right-handed left-eyed persons were third in motor ability. Working with a battery of seven different items to establish motor ability, Roth (22) noted that the pure dextrals (right-eyed and right-handed) showed superiority in the one item involving foot-eye co-ordination (punt) and a lesser degree of superiority in the one item involving hand-eye co-ordination (baseball throw). None of the differences were statistically significant.

Procedure

A college class of 32 first- and second-year women students was selected for the study. The class was designated as Elementary Swimming and was relatively homogeneous in swimming ability. All were reasonably well-oriented to shallow water and a number were quite at home in deep water but lacked skill in strokes and fundamentals. In conducting the class, the usual instructional procedures were followed. The side stroke was introduced when the majority of the class had established the flutter kick and the fundamental co-ordination of the crawl stroke. In the introduction and development of both strokes, the students were allowed free choice of sides for breathing drills, for breathing in the crawl, and for swimming the side stroke.

Data concerning dominance were secured as follows:

Handedness (9)

(1) The student was asked which hand she used for the more common acts such as as eating, writing, and throwing. This was recorded for each student.

(2) The student was asked which way she batted, left- or right-handed. This was recorded for each student.

(3) A sweeping trial was conducted; typically the right-handed person (a) placed the right hand near the top of the broom; (b) swept from the left side; (c) kept the right hand on top when changing the broom to the opposite side. Variations were recorded as to these three items.

Eyedness (7, 16)

A sighting test was given each student to determine the dominant eye, and she then was classified as right-, left,- or ambi-eyed.

Footedness (12, 13)

A kicking test was given to determine footedness. A soccer ball was placed about 25 feet from a door. As each student approached the ball, she was told to kick the ball at the door with as much force as possible. The foot used in kicking was recorded as dominant.

Breathing side in crawl

Each student swam across the pool with a coordinated crawl stroke and the breathing side of each was observed and recorded.

Sidestroke side

Each student swam across the pool with a coordinated sidestroke and the swimming side of each student was observed and recorded.

Findings of the Study

DOMINANCE

The dominance of subjects as shown by handedness, eyedness, and footedness is given in Table 1.

TABLE 1

Frequencies and Associations of Dominance Factors

Dominance Factors	RE	RF	Right-handed					LE	LF	AE	Total
			5	4	3	2	1				
RERF5	16	16	16								16
RERF4	5	5		5							5
RERF2	1	1				1					1
RELF4	1			1					1		1
LERF5		4	4					4			4
LERF4		2		2				2			2
AERF5		2	2							2	2
AERF2		1				1				1	1
Total	23	31	22	8	0	2	0	6	1	3	

NOTE: RE and LE = right- and left-eyed; AE = ambi-eyed
RF and LF = right- and left-footed
1 — 5 refers to number of test items classified as *right* in 5-item battery for handedness.

Of the 32 students tested 16 (50%) showed complete right dominance of the hand, eye, and foot. Fifty per cent (16) showed some variation or incompleteness of the right dominance pattern—three of hand and eye, one of

hand and foot, six of eye only, and six of hand only. These findings are in agreement with those of other investigators (5, 8, 13).

SIDE PREFERENCE

The side preferences of swimmers are given in Table 2. This table shows a rather evenly divided preference for right and left sides; the greatest frequency is in the preference of crawl swimmers for breathing to the right (19).

In analyzing the association between choice of breathing side for the crawl and preferred position for the side stroke in this study, it is apparent from Table 2 that 24 of the 32 subjects showed a consistent swimming pattern[1] (reverse relationship of breathing side for the crawl and choice of swimming side for the side stroke) while only eight swimmers chose to breathe to the same side as that on which they swam the side stroke (inconsistent pattern).[2] In order to determine the significance of this relationship it was necessary to find chi square[3] and to use Yates' corrections because of the small number of frequencies. X^2 was found to be 6.57. This establishes the relationship as significant at better than the 2 per cent level of confidence.

TABLE 2

Side Preferences and Relationships in Crawl and Sidestroke

Side Preferences	f (1)	f (2)	No. Br R Sw L	No. Br L Sw R	CP	Br R Sw R	Br L Sw L	IP
Subjects Breath R	19							
Of these Sw L		14	14		14			
Of these Sw R		5				5		5
Subjects Breath L	13							
Of these Sw R		10			10			
Of these Sw L		3					3	3
Subjects Sw R	15							
Of these Br L		10		10				
Of these Br R		5						
Subjects Sw L	17							
Of these Br R		14						
Of these Br L		3						
Total			14	10	24	5	3	8

NOTE: $X^2 = 6.57$. P is between .01 and .02.
CP = Consistent Pattern in the two strokes.
IP = Inconsistent Pattern in the two strokes.

Study of Table 3 reveals identical distribution of consistent (12) and inconsistent pattern (4) frequencies among the 16 students with complete dominance when compared to those with incomplete dominance. A similarly even distribution is apparent in Table 3, where a comparison is made with reference to breathing habits and consistency of swimming pattern.

[1]This reversed relationship is hereafter referred to as "consistent pattern."

[2]This choice of same side is hereafter referred to as "inconsistent pattern."

[3]Although the use of chi square usually assumes a random sampling its use in this case is as justified by Guilford, J. P. *Fundamental Statistics in Psychology and Education.* New York: McGraw Hill Book Co., 1950.

TABLE 3
Frequencies of Dominance and Sidedness in Swimming

Frequencies	CD	ID	CP	IP
Br. R in Crawl	9		7	2
Br. L in Crawl	7		5	2
Br. R in Crawl		11	8	3
Br. L in Crawl		5	4	1
Crawl N			24	8

NOTE: CD = Complete right dominance.
ID = Incomplete right dominance.
CP = Consistent pattern of swimming.
IP = Inconsistent pattern of swimming.

Since, as presented in Table 4, 15 of the right-eyed swimmers breathed to the right and four of the left-eyed swimmers breathed to the left, it seemed possible that a relationship might exist between eye dominance and sidedness.

TABLE 4
Relationship of Eyedness and Side Preferences in Crawl and Side Stroke

	Eyedness			Pattern of Swimming		Breathing to		Swimming on	
Side Preferences	R	L	A	Consist.	Incon.	Eyed Side	Opp. Side	Eyed Side	Opp. Side
Swimmers Br R Sw L	11	1	2	14		11	1	1	11
Swimmers Br L Sw R	6	3	1	10		4	6	6	3
Swimmers Br L Sw L	2	1	0		3	3	2	1	1
Swimmers Br R Sw R	4	1	0		5	1	1	4	2
	23	6	3	24	8	19	10	12	17

NOTE: $X^2 = 1.95$. P is between .10 and .20.

Although the number of frequencies were smaller than usually recommended for the utilization of chi square, it was computed and found to be 1.95, which is smaller than required for establishing significance (rejected between the 10 and 20 per cent levels of confidence). There was even less indication that handedness or footedness was a determining factor in sidedness choices of swimmers.

Discussion

Dominance of the subjects as to eye, hand, and foot agreed closely with results found by other investigators of similar populations. The concept of complete and incomplete dominance with respect to the three factors appears to be useful in the study of groups of right-handed persons.

The factor of laterality in swimming was found to vary in the two strokes, and no relationship to the dominance of handedness or footedness was evident.

A relationship was suspected between eye dominance and the breathing side for the crawl but the computation of chi square did not establish it as significant. Since the crawl was established before the sidestroke was started,

this choice may have conditioned the preference for the sidestroke also; i.e., stroke started first may be given the preferred laterality which then determines at least in part the laterality for the second stroke.

A clear relationship was found between the two strokes: subjects tend to swim with a reversed relationship in the two strokes so that a swimmer will breathe to the left in the crawl and swim on the right in the sidestroke or vice versa. The choice of sides was evenly distributed in the two strokes and the reversed relationship was clearly indicated to occur in both combinations (both R L and L R).

This study suggests the complexity of laterality as a factor in motor learning. Laterality should not be disregarded and the implication of this and other investigations is that further study is needed.

This study indicates that the teacher of swimming should expect and perhaps promote a consistent pattern in the crawl and side strokes and that attention to movement patterns as related to laterality should be given, particularly at the elementary level of swimming when habits are being established.

Conclusions

Within the limits of this study it was found that:

1. There is a significant relationship between the breathing side in the crawl and the swimming side in the side stroke; this relationship is reversed so that a swimmer who breathes right tends to swim on the left and one who breathes left tends to swim on the right.

2. Dominance of eye, hand, and/or foot is not significantly related to side preference for breathing in the crawl stroke and swimming in the side stroke.

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Effect of Motivational Stress Upon Physical Performance[1]

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Abstract

This is a pilot study to investigate the relationship existing between specific kinds of motivation and work output, oxygen consumption, mechanical efficiency, and several aspects of cardio-respiratory response in men and women. It was found that the reaction of men and women to motivation is similar in kind and quality; that motivational techniques elicit greater work output; and that when motivational stressors indicating success are employed, the gross mechanical efficiency of the body is greater than when neutral stressors or stressors indicating failure are employed.

VARIOUS motivational techniques have long been used as a means of encouraging individuals to perform better, both qualitatively and quantitatively. Empirically, it has been reasoned that motivation produces a stressful situation and the process of resolving that stress produces greater effort which results in improved performance. Research findings related to this argument are not in complete agreement.

More specifically, in the field of physical education, where motivational techniques are often employed, there has been some concern about the types of motivation which may be used constructively in competitive sports situations. Figuratively, there is the "pat them on the back" school of thought, the proponents of which have utilized praise and encouragement to further the work output of the individual. Conversely, the opposing school of thought, figuratively termed the "bawl them out" school, has contended that adverse criticism and threat of failure are the best techniques for motivating greater work output. Realistically, most teachers and coaches of physical activity have used both types of motivation, attempting to get the best results in terms of the situation at hand and their subjective interpretation of it.

Some comparative research has been done on the results of different motivational techniques, but little research on the relation of different types of motivational techniques to the mechanical efficiency and physiological functioning of individuals has been reported. In the face of the many controversial practices and opinions, there seems to be need for further objective

[1] A pilot study done at the University of Southern California under the direction of Dr. Eleanor Metheny.

findings. The purpose of this study was to investigate the effects of "encouraging" reports of success and of "discouraging" reports of failure on work output, mechanical efficiency, and associated cardio-respiratory functions, and to determine sex differences in such possible relationships.

Procedure

SUBJECTS

A total of 18 subjects, nine men and nine women, were used. All were majors in physical education at the University of Southern California.

INSTRUMENTATION

A frictional bicycle ergometer, constructed according to specifications outlined by Karpovich (2), was used to provide a standard exercise situation and to measure externally-produced work.

A standard Benedict-Roth basal metabolism apparatus of the closed circuit type, manufactured by Warren E. Collins, Inc., was used to measure oxygen consumption, respiration rate, minute volume, and amplitude of respiration.

Other instruments included an electric clock with a sweep-second hand, a stopwatch, and a manually operated push-button bell and buzzer set.

EXPERIMENTAL CONDITIONS

Motivation. The subjects participated in exercise trials involving three varieties of motivational stress on three different days. One motivational condition, called the "base trial," was administered during the subjects' first visit to the laboratory. The subject was told that he was to pedal the bicycle for one minute, and that the time would be reported to him at the end of 30 seconds and again at the end of 45 seconds. He was told that he should produce as many revolutions as possible, but that some pacing would be necessary, since all-out work would result in exhaustion before the expiration of the one minute period. Subjects were not told about the real nature of the experiment or about the conditions under which they would ride in subsequent trials, but were only informed that the study involved the determination of the relationship between oxygen consumption and work output.

When the subject reported for his second and third trials, he was told that he was to perform as on the base trial, except that he would hear a bell ring periodically after ten seconds of exercise if he was exceeding the record that he established on his base trial, and that he would hear a buzzer ring periodically if he was not doing as well as he had on his base trial. He was asked again to do his best, and to equal his record for the base trial, if possible. Unknown to the subject, the experimenters determined in advance whether the bell or buzzer would ring during these trials. Subjects were randomly split into two groups. Group I, composed of five women and four men, heard the bell on the second trial and the buzzer on the third trial, regardless of their actual performances. Group II, composed of four women and five men, heard the buzzer on the second trial and the bell on the third trial, regardless of their actual performances. Subsequent to the experiment

it was determined by questioning the subjects that this systematic prevarication was successful in convincing the subjects in all instances except one, in which, by chance, the auditory signal happened to be giving a true report of the performane in comparison to the score on the base trial.

Each subject, therefore, heard the bell on one trial and the buzzer on the other, subsequent to the base trial. Hereafter, the terms *bell-motivated exercise bout* and *buzzer-motivated exercise bout* are used to refer to the motivational conditions. Thus, the motivational conditions are operationally defined. In general, the bell represented success, in that it led the subject to believe that he was exceeding his first performance, while the buzzer represented failure, in that it led the subject to believe that he was less successful than he had been during his first performance.

Order. In an attempt to avoid possible interaction influences of order on presentation of bell and buzzer motivated trials upon other variables, half of the subjects were randomly assigned to the bell-buzzer order on the second and third trials, and the other half were assigned to the buzzer-bell order. The order influence was also examined statistically.

Direct and Derived Measurements

PULSE RATE DATA

For each subject and for each exercise trial, four pulse rates were recorded: (1) resting, taken just before exercise; (2) exercise, taken immediately after cessation of exercise; (3) recovery, taken two minutes and 45 seconds after cessation of exercise; and (4) five minute, taken four minutes and 45 seconds after exercise. All of these were 15 second counts. A derived figure, called net pulse, was obtained by subtracting resting pulse from each of the other three pulse rates, and adding the three figures so obtained. This net pulse figure was taken to be an estimate of the excess heart rate caused by exercise.

RESPIRATION RATE

For each subject and for each exercise trial, three respiration rates were recorded: (1) resting, taken for one minute prior to exercise, (2) exercise, taken for one minute during exercise, and (3) recovery, taken for one minute immediately following exercise. All respiration rates were determined by counting the peaks (or valleys) on the kymograph record for the appropriate time interval. A derived figure, called net respiration rate, was obtained by subtracting the resting respiration rate from the exercise respiration rate and from the recovery respiration rate, and adding the two figures so obtained.

AMPLITUDE OF RESPIRATION

For each subject and for each exercise trial, the three measurements of amplitude of respiration were recorded: (1) resting, taken for one minute prior to exercise, (2) exercise, taken for one minute during exercise, and (3) recovery, taken for one minute immediately following cessation of exer-

cise. These were all average figures for the period in question. Because of the close similarity of amplitudes of successive respirations, the following method was employed in reading amplitude of respiration from the kymograph record: A straight line was fitted to the peaks of the respiration tracings, and another was fitted to the valleys. The distance between these two lines at the beginning of the period in question and at the end of the period were measured in graph units (millimeters). An average of the two was calculated and the results were recorded in arbitrary graphic units. The average was used because there was frequently a noticeable difference in amplitude of respiration at the beginning and at the end of the period. Since the transitions in amplitudes during the period were almost invariably regular, this method was considered adequate. A derived measurement, called the net amplitude of respiration, was calculated in the same manner as the net pulse rate and the net respiration rate already described.

NET MINUTE VOLUME OF RESPIRATION

Another derived measurement was net minute volume of respiration, obtained by multiplying net respiration rate by net amplitude of respiration. This measure was taken to indicate the additional minute volume over resting level for the period of exercise plus one minute of recovery.

OXYGEN CONSUMPTION

The Warren E. Collins, Inc., Chart B-R12, upon which the kymographic recording was made, is ruled off so as to simplify the calculation of oxygen consumption. From this chart uncorrected oxygen consumption in calories per hour was calculated. Correction for atmospheric pressure and temperature was made. Oxygen consumption was further corrected by dividing body surface in square meters, thus rendering corrected oxygen consumption in calories per hour per square meter of body surface.

ERGOMETER WORK

The ergometer work was measured in terms of calories per hour. The work equalled 61.67 foot-pounds per wheel revolution. As Karpovich (2) has indicated, this value is constant regardless of changes in speed of pedaling. Wheel revolutions were counted for one minute and the foot-pounds of work done were divided by 3086 which equals one calorie when the respiratory quotient is assumed of an average mixed diet. Thus, ergometer work was reported in terms of calories per hour, permitting direct comparison with oxygen consumption values.

GROSS MECHANICAL EFFICIENCY

The oxygen consumed during the exercise was added to twice the oxygen consumed in one minute after exercise and this was divided into ergometer work. In using "twice the oxygen consumed in a minute after exercise," the assumption is that incurred oxygen debt would be paid back in exactly two minutes, and that the rate of payment would be linear during this time. The real rate of payment is, of course, curvilinear with time, and textbooks suggest that about three minutes would be required. Therefore, the calculation employed is an arbitrary one. It was selected after rank-order correlations

between ergometer work and oxygen consumption, using it and other formulae, showed no difference to indicate a preference. The experimenters made the final decision in its favor, after carefully studying recovery curves, because it seemed to approximate the figures which would have been obtained by using complex curvilinear formulae.

NET MECHANICAL EFFICIENCY

Net mechanical efficiency was calculated in the same manner as gross mechanical efficiency, except the net exercise oxygen consumption and the net recovery oxygen consumption were used instead of the gross figures. The net efficiency scores were abandoned in favor of the gross efficiency scores because of the possibility that errors occurring through the failure of some of the subjects to reach true resting state would be magnified by use of this second-order derived statistic.

Analysis of Data

The experiment was designed to investigate differences in performance of individuals under buzzer-motivated, bell-motivated, and base conditions. Raw data could have been analyzed, but since the interest was in changes and the significance of changes, the raw measurements of most variables under bell-motivated and buzzer-motivated conditions were converted by subtracting from them the raw measurements made under base conditions. This yields a difference of the first order for each individual and each variable so treated. Raw measurements under base conditions were in effect reduced to a "zero level." Raw measurements under motivated conditions were expressed as "differences from base or zero level." Next, second-order differences between these differences could be considered, and their significance determined. The situation is clarified if, subsequently in this report, the first-order differences are thought of as raw scores and the second-order differences are thought of simply as differences.

Three of the variables—sex, body surface area, and groups—do not change with the changes in experimental conditions, and do not lend themselves to conversion to first- or second-order differences. Original raw measurements or determinations were used to express these variables. Group, it must be remembered, refers merely to the order of presentation of the two motivated conditions, and groups were established to allow evaluation of pure practice effects of repetitive administration of the tests.

Numerous hypotheses were tested, and these may be classified into three sets. The first set of hypotheses concerned sex, surface area, and order differences; the second set of hypotheses concerned performance relationships between bell- and buzzer-motivated conditions; and the third set of hypotheses concerned performance relationships between base conditions and bell- or buzzer motivated conditions. Null hypotheses were formulated for all suggested relationships, and statistical reasoning followed the usual pattern.

Table 1 summarizes the testing of the first set of hypotheses. Chi-square tests revealed no significant sex differences in work output or gross efficiency.

TABLE 1
Summary of Chi-Square Relationships

Source of data	Chi-square	df	Significance
Work output of groups in relation to buzzer and bell	1.6364	1	
Work output of sexes in relation to buzzer and bell	.0654	1	
Sex in relation to body surface over and under 1.91 square meters	14.2224		1%
Gross efficiency of groups in relation to buzzer and bell	.0000	1	
Gross efficiency of sexes in relation to buzzer and bell	.2500	1	
Work output of groups in relation to bell and base	.0000	1	
Work output of sexes in relation to bell and base	.2770	1	
Gross efficiency of groups in relation to bell and base	.2500	1	
Gross efficiency of sexes in relation to bell and base	.0000	1	
Work output of groups in relation to buzzer and base	.0602	1	
Work output of sexes in relation to buzzer and base	.0602	1	
Gross efficiency of groups in relation to buzzer and base	.0000	1	
Gross efficiency of sexes in relation to buzzer and base	.0000	1	

(It must be emphasized that first- and second-order differences, not raw amounts of work output and gross efficiency, were considered here.) Similarly, chi-square tests revealed no significant differences between groups with regard to work output or gross efficiency. Thus, the sex classification of subjects was ignored in all subsequent analyses, and it was concluded that order or pure-practice effects would not influence any subsequent analyses. A final chi-square test indicates a highly significant difference in surface area for men and women, verifying the well-known fact that men tend to be larger than women.

Table 2 indicates the method of testing of the second set of hypotheses, concerning the relationship of the bell-motivated condition to the buzzer-motivated condition with regard to net pulse rate, net respiration rate, net amplitude of respiration, net oxygen intake, gross efficiency, and work output, respectively. The data were arranged to permit analysis of variance, and the F test was used to determine statistical significance of differences. For each variable, all of the data for the two sexes and the two motivated conditions were arranged in a four-cell design. It is important to note that the test of significance for sexes was based upon randomly-assigned subjects, whereas the test of significance for conditions was based upon the same subjects measured repeatedly, and thus involves some correlation. For this reason, two separate error terms for the tests of significance were used, as suggested by Edwards (1). One of these was for correlated data obtained from the same subjects, and the other for data from independent groups.

The analyses of variance revealed no statistically significant relationships in regard to net pulse rate, net respiration rate, net amplitude of respiration,

or net oxygen intake. With regard to gross mechanical efficiency and net minute volume, the differences between the motivated conditions (but not between the sexes) were statistically significant. In the case of gross mechanical efficiency, the difference was positive in the direction of the bell-motivated condition; and in the case of net minute volume, the difference was positive in the direction of the buzzer-motivated condition. For total work output, no difference was found to be acceptable at strict levels of acceptability, but the difference between work output under buzzer- and bell-motivated conditions was significant at the 7 per cent level, in favor of the latter. Only the analyses involving statistically significant differences are reported in Table 2.

TABLE 2
Summary of Analysis of Variance

Source of Variance	df	Sum of Squares	Mean Square	F
Gross Efficiency Data				
Between sexes	1	3.18	3.18	
Between subjects in the same group	16	300.10	18.75	
TOTAL SUM BETWEEN SUBJECTS	17	303.28		
Between conditions	1	39.06	39.06	4.51*
Interaction	1	.00	.00	
Pooled subjects and trials	16	138.57	8.66	
TOTAL SUM WITHIN SUBJECTS	18	177.63		
Net Minute Volume Data				
Between sexes	1	7,054,336.00	7,054,336.00	
Between subjects in the same group	16	44,303,030.11	2,768,939.38	
TOTAL SUM BETWEEN SUBJECTS	17	51,357,366.11		
Between conditions	1	1,026,844.44	1,026,844.44	8.78**
Interaction	1	196,249.00	196,249.00	
Pooled subjects and trials	16	1,870,419.45	116,901.22	
TOTAL SUM WITHIN SUBJECTS	18	3,093,512.89		

* Significant at the 5% level of confidence in the direction of the bell-motivated efficiency.

** Significant at the 1% level of confidence in the direction of the buzzer-motivated volume.

Table 3 summarizes the testing of the third set of hypotheses, concerning the relationship of each of the motivated conditions to the base condition, with regard to net pulse rate, net respiration rate, net amplitude of respiration, net oxygen intake, gross efficiency, and work output. Since there was no evidence of significant differences between sexes, the data for subjects are not segregated on the basis of sex. Fisher's t-test, using formulae for correlated data, is appropriate here. All differences were found to be significant at acceptable levels of confidence, except the differences in net oxygen intake from base to bell-motivated and from base to buzzer-motivated conditions, and the differences in gross efficiency from base to buzzer-motivated conditions. Exact differences and significance levels are shown in Table 3.

TABLE 3

Differences for Individuals Between Base Exercise Bout and Bell-Motivated Exercise Bout; and Between Base Exercise Bout and Buzzer-Motivated Exercise Bout.

Variables	Differences	Conditions	
		Base Exercise Bout to Bell-Motivated Exercise Bout	Base Exercise Bout to Buzzer-Motivated Exercise Bout
Net pulse rate	Mean difference	23.00	22.33
	t	2.47	2.63
	Level of confidence	3%	2%
Net respiration rate	Mean difference	8.00	8.94
	t	3.40	5.05
	Level of confidence	1%	1%
Net amplitude of respiration	Mean difference	22.98	23.94
	t	2.98	2.82
	Level of confidence	1%	2%
Net oxygen intake	Mean difference	—22.56	19.28
	t	.50	1.34
	Level of confidence		
Gross efficiency	Mean difference	2.87	.78
	t	2.79	1.26
	Level of confidence	2%	
Work output	Mean difference	7.39	4.00
	t	3.02	2.16
	Level of confidence	1%	5%

Table 4 is a recapitulation of the direction and significance of all relationships tested by the three sets of hypotheses.

Conclusions

Sex differences were not found to influence the results significantly, so far as first- and second-order differences were concerned. In the absence of evidence to the contrary, it was possible to disregard the sex difference variable in evaluating the reactions of individuals to kinds of motivated and non-motivated exercise.

The order of presentation of the two kinds of motivational stress was not found to influence the results significantly. Different orders of presentation were introduced as a device to allow detection of possible contamination of measurements by pure practice influences, and none was found.

The bell-motivated and the buzzer-motivated conditions both elicited greater work output from the subjects, with the accompanying changes in cardio-respiratory function in comparison to the base condition. Further, there is a suggestion that work output under the bell-motivated condition is greater (at the 7% level of confidence) than work output under the buzzer-motivated

TABLE 4
Summary of Significant Differences[1]

Variables	Field of Differences				
	Sex Men vs. Women	*Exercise Bout* Bell-Motivated vs. Buzzer-Motivated	*Exercise Bout* Base vs. Buzzer-Motivated	*Exercise Bout* Base vs. Bell-Motivated	*Sequence* Bell-Buzzer vs. Buzzer-Bell
Work output		Signif. at 7% level in favor of bell	Signif. at 5% level in favor of buzzer	Signif. at 1% level in favor of bell	
Gross efficiency		Signif. at 5% level in favor of bell		Signif. at 2% level in favor of bell	
Body Surface area	Signif. at 1% level in favor of men				
Net minute volume		Signif. at 1% level in favor of buzzer			
Net amplitude of respiration			Signif. at 2% level in favor of buzzer	Signif. at 1% level in favor of buzzer	
Net pulse rate			Signif. at 2% level in favor of buzzer	Signif. at 3% level in favor of bell	
Net respiration rate			Signif. at 1% level in favor of buzzer	Signif. at 1% level in favor of bell	
Net oxygen intake					

[1]Blank spaces indicate that differences were found to be insignificant.

condition. However, the bell-motivated exercise bout (which indicated success in relation to the base score) was accompanied by an increase in gross mechanical efficiency. When the bell-motivated exercise bout and the buzzer-motivated exercise bout were compared, it is apparent that there is greater gross mechanical efficiency in the direction of the bell-motivated exercise bout. This would suggest that knowledge of success under the conditions described contributes to some extent to the mechanical efficiency of the individual, while knowledge of failure causes a respiratory adjustment over and above that needed for the work involved. This may be attributed to an emotion response to this kind of motivational stress.

In this exploratory study, generalization on the conclusions is limited by the fact that the subjects represented a special population, and by the specific characteristics of the total motivational climate which prevailed. With the restrictions imposed by these facts, these conclusions seem justified:

1. The reactions of men and women to motivational stressors, as measured in this experiment, are similar in kind and quality.
2. Greater work output is elicited by the use of organized motivational stressors than is elicited when those stressors are omitted.
3. Significant cardio-respiratory changes occur when organized motivational stressors are employed. Specifically, these are: a. Increase in pulse rate. b. Increase in respiration rate. c. Increase in amplitude of respiration.
4. When motivational stressors indicating success are employed, the gross mechanical efficiency of the body is greater than when neutral stressors or stressors indicating failure are employed.
5. When motivational stressors indicating failure are employed, minute volume of respiration is significantly greater than when motivational stressors indicating success are employed, in spite of a suggestion that stressors indicating success may possibly (at the 7% level of confidence) result in greater work output than occurs when stressors indicating failure are employed.
6. There is permissive evidence for (and no evidence against) the possibility that motivational stressors indicating failure cause an emotional reaction which circumvents the occurrence of an increased gross mechanial efficiency such as occurs with the utilization of motivational stressors indicating success.
7. Motivational stressors indicating success and those indicating failure are both effective if increased work output is the object, but those indicating success are to be preferred if a choice is to be made.

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Biological Changes in American Women in the Last Fifty Years[1]

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Abstract

A review of research relative to biological changes in women during the last 50 years can be summarized under four main topics: (1) there are more women than men in the population of America today; (2) women tend to live longer than men; (3) women seem to resist diseases better than men and seem to respond more readily to medical treatment; and (4) women are increasing in most anthropometric measures. It appears that old women and their ailments will be an acute problem for future generations.

ADULT American white women appear to be biologically superior today—superior to adult American women prior to the 20th century and, in some biological aspects, superior to white men of like ages. Numerous tabulations of statistics could be compiled to substantiate the above statement, but the purpose of this paper is to point out trends rather than to accumulate such evidence.

Changes in status of women tend to revolve around four main topics: 1. There are more women than men in the population of America today; 2. Women tend to live longer than men; 3. Women seem to resist diseases better than men and seem to respond more readily to medical treatment; and 4. Women are increasing in most anthropometric measures.

The majority of the evidence quoted in the development of the first three topics is taken from the *Statistical Bulletin* of the Metropolitan Life Insurance Company. Since this type of population sample is composed primarily of industrial policyholders, figures presented should be more typical of the total population than most isolated research papers. The latter are necessarily limited both in scope and number of subjects.

Population Trends

Although more boys than girls are born each year, the higher death rate of males has been gradually reversing the sex ratio. The number of male births per 1,000 exceeds female births by approximately 50 (26). This higher male birth rate has been relatively constant since 1930, with the highest ratio of male births occurring in 1946 (1,059 males per 1,000 females). However,

[1]This review of literature relating to biological changes in the American woman was prepared for and presented at the 1957 Central Association Convention for Physical Education of College Women held in St. Louis, Mo., April 8, 9, 1957. Papers on psychological and sociological changes, also presented at this CAPECW meeting, are in the *Biennial Record, 1955-57*, of the National Association of Physical Education for College Women.

in the total population, including all age levels, the females outnumbered the males for the first time in the United States in the census of 1950, but only by 1 per cent (18). It is estimated that the female margin will grow to 3 per cent by 1975. This trend is a reflection of a very rapid rise in the excess of females at ages 45 and over.

The age composition, without reference to sex, of the American population also is presenting a rapidly changing pattern (12). If five major age groupings are compared for 1900 and 1950, with the population of each group expressed as a percentage of the total population, the change in age composition can be demonstrated clearly (see Table 1).

TABLE 1
Percentage of Population in Each Age Grouping in Years 1900 and 1950

Year	Under 5 yrs.	5-19 yrs.	20-44 yrs.	45-64 yrs.	64 yrs. and over
1900	12.1	32.3	37.8	13.7	4.1
1950	10.8	23.5	37.3	20.2	8.2

A second glance at the sex ratio, with the above aging population in mind, will provide a more realistic picture for the adult population (over 21 years). The ratio of men to women has been decreasing steadily for over four decades in the United States (26). In 1910 there were 1,097 adult men for every 1,000 adult women. By 1940, the adult sexes were numerically balanced and ten years later the adult men were outnumbered—966 for every 1,000 women. Two other reasons, in addition to the aging population, are suggested for the change in ratio: 1. Changing character of immigration (1910 immigrants showed preponderance of males); 2. War losses and men permanently stationed overseas. Estimates for the future mark the excess of females still more drastically. In 1975, at ages 45-64, the females will exceed the males by more than 10 per cent and at ages 65 and over, by 40 per cent (18).

Many individuals have felt that the western states provided a Mecca for unmarried women because of the great surplus of men, migrants who helped develop our vast western states. It is true that the men do still outnumber the women in all western states except Colorado and California (26). This margin in favor of the male is fast diminishing, with the greatest decrease in ratio in Nevada (15% in 10 years). Rhode Island is the only state in the Union in which the male population has increased in the past ten years.

Longevity

We are rapidly becoming a much older populace, an accumulative result of steady improvement in longevity by both sexes during the past half century (see Table 1). Longevity gains since the turn of the century have been much greater than were similar gains in the preceding 50 years (19). Longevity may be discussed in terms of decrease in death rate or in figures that represent an increase in life expectancy. Death rates from all causes (excluding

enemy action) from 1911 to 1950 have been summarized by the Metropolitan Life Insurance Company (17). In the past four decades, the death rate for white males dropped at least 70 per cent at each of nine five-year age groupings under 45 years of age; at ages below five years, the drop amounted to 90 per cent. The relative decrease lessened with advanced age but amounted to as high as 37 per cent reduction at ages 65 and over. The record for the white female surpassed that for males at every age period, with figures ranging from 91 per cent decrease at ages below five years to 49 per cent at ages 65 and over. Insurance statistics show a gradual rise in these percentages when mortality rates for 1953, 1954, and 1955 are compared with the same 1911 base. For example, the death rate reduction for white females over 65 years of age amounted to more than 50 per cent when the 1953 and 1911 death rates were compared (23).

Life expectancy at birth has shown parallel increases (7). From 1900 to 1951, in the white population, the rise in life expectation has been 21½ years for females and 18⅓ years for males. (The average length of life is about eight years less for non-whites.) Thus, the life expectancy of the average white American has been lengthened by over 40 per cent since the beginning of the century. Although these gains have been largest in childhood and early adult life, some definite progress has been made at the older stages of life (19). In 1952, at the age of 64, a white man could look forward to 13 years while his wife should have 15⅓ additional years of life. In contrast, in 1900, a white man of the same age would have expected only 11½ years and his wife 12⅓ years (an improvement of 1½ and 3 years respectively). The increase in longevity has been greater for females than for males at all ages.

Resistance to Disease and Infection

Women tend to respond more favorably than men to new types of treatment, even in diseases that have long been considered prime killers of women. Women also tend to resist many diseases better than men. Only a few of many possible examples illustrating these statements will be given here. The flood of recent information relative to heart disease has made most individuals aware of the vulnerability of the male in disturbances of the heart and circulatory system. Among white males in this country, the death rate from heart disease rose from 203 per 100,000 in 1931-35 to 226 per 100,000 in 1951-54. During the same 20 years, the death rate for the same heart diseases among white females dropped from 140 to 105 per 100,000 (16). For all ages combined, mortality from heart disease among males is about double that among females, but, at the age range 35-54 years, the death rate among males is about three times that among females (27).

Cancer ranks second to heart disease as a cause of death in midlife (45-54 years). One out of every eight persons reaching the age of 45 can expect to develop cancer by the age of 65 (9). Here again, the woman of today is favored. The cancer death rate among middle-aged men was 13 per cent higher than for women of the same age in 1955-56. However, ten years

earlier, the death rate for men in the same age bracket was 11 per cent *below* the rate for women. In the next older age bracket (55-65 yars) the cancer death rate for men is over 50 per cent greater than for women. Some of this increase is undoubtedly due to the marked increase in respiratory cancer mortality among men during the last two decades. The ratio of male to female deaths due to respiratory cancer was 4½ to 1 in 1953 (29).

This same trend of lower death rate for the female holds for numerous other diseases, only a few of which are mentioned here. Mortality from peptic ulcer is much greater among men than women. For ages 35-74, the range including most deaths from ulcer, the rate was six times as high among white males as among white females (1954). For a like age range, the sex-ratio for duodenal ulcers was 7 to 1 (11). Diabetes mortality has been decreasing in recent years with the largest decrease among white females (15). It is generally accepted that over-weight people suffer a considerably higher mortality than those of normal weight. Although both sexes display the same general pattern, the over-all health risk is slightly higher for men than women (22).

The reduction in mortality from pneumonia and influenza can be given as a specific example of better response to treatment. In spite of the fact that women are considered particularly susceptible to respiratory disturbances, the death rate among white women has dropped nearly 90 per cent in the last 15 years (24). At all ages, except childhood, since the large scale introduction of chemo-therapy, females have shown a greater relative decline than men in deaths caused by pneumonia and influenza (20). Again, the extraordinary progress made in the control of tuberculosis in the last half century is evident by the reduction of this disease from prime killer to tenth place (6). White females again made the best record, with a 97 per cent decrease in death toll between 1911 and 1953 as compared with a 94 per cent decrease for men. Gall bladder diseases are especially known for the heavy toll they have taken among women. In 1936-38 the death rate among adult females exceeded that among males by 125 per cent, but 15 years later (1951-53) the excess was reduced to 60 per cent—a drop of more than half. This reduction can be attributed to a decrease in surgical mortality, control of infection by chemo-therapy and antibiotics, preventing surgical shock, and prevention of pulmonary embolism (14).

On the other hand, there are some infections and diseases where women take the lead in mortality rates. Gall bladder diseases, mentioned above, are a frequent cause of death among women. Disorders of the thyroid gland affect many more females than males (28). Women are responding well to treatment, however, as evidenced by the drop in toxic goiter death rate since 1945 (75 and 70 per cent drop for females and males respectively). In contrast to the current trend in cancer mortality, cancer of the thyroid has been moderately upward among older women. Diabetes shows a distinctly higher mortality for females than males (10).

Women tend to be afflicted with a higher incidence of disabling illnesses and chronic diseases, and the frequency of attack increases with advance in

age. In early adulthood, the incident rate for new cases of cancer was 75 per cent higher for women (1953) but deaths owing to malignancy dropped markedly for women between 1943 and 1953 (8). The upward trend in disabling incidences of chronic rheumatic diseases was considerably higher for females in 1955 (13). This high incidence rate for women increases progressively with age and is almost three times greater for older women. Chronic rheumatism has a relatively small effect on longevity. During the later stages of the working period of life, disabling illnesses for women occur much more frequently, but the average period of disability is longer for men. Respiratory system diseases constitute the major cause of disability for females throughout the working ages, representing four times that of the male at ages over 25. At all ages above ten years, women have a higher incidence of acute respiratory infection than do males (25).

Table 2 summarizes some of the factors relative to sex relationships as an influence on mortality, resistance to disease, and frequency of attack.

TABLE 2

Some Sex Differences in Mortality Rates, Response to Treatment, and Frequency of Attack

1. Many diseases show sex differences among mortality rates:

A. Male exceeds the female	B. Female exceeds the male
Cancer	Cancer of Thyroid
Duodenal Ulcer	Diabetes
Heart Disease	Gall Bladder Disease
Obesity	Thyroid Gland Disorder
Peptic Ulcer	

2. Women tend to respond to treatment better than men in the following diseases:
   - Diabetes
   - Gall Bladder Disease
   - Influenza
   - Pneumonia
   - Tuberculosis

3. Frequency of attack is greater for the female than the male in these types of diseases and disabling illnesses:
   - Cancer in Early Adulthood
   - Chronic Rheumatic Diseases
   - Respiratory System Diseases

Changes in Stature and Weight

The Harvard study of *New Types of Old Americans* (1) gives a very good indication of anthropometric changes in women in spite of the fact that the report is 25 years old and the data still older. Four women's colleges (Wellesley, Vassar, Smith, and Mt. Holyoke), and 570 pairs of mothers and daughters (501 mothers and their 570 daughters) furnished the data relative to women. The majority of the subjects (and all subjects with measurements other than height and weight) came from Wellesley and Vassar. The an-

cestors, for over 90 per cent of the cases, were of American parentage for at least two generations.

The average age of daughters studied (17.88 years) was less than the average age of mothers (18.76 years). Daughters showed considerably more uniformity in stature and slightly less uniformity in weight than mothers. The mean stature for mothers was 161.60 cm., while the mean stature for daughters was 164.53, an increase of 2.93 centimeters over the mothers. Tabulation of stature by birth decades showed an irregular but marked increase regardless of decrease in age for daughters (see Table 2). There was a mean decade increase of 2 cm. or an annual increase of .08 (exactly same as for men), which means that every 15 years there was a significant increase in height. Jackson in 1925 and Hrdlicka in 1930 found an increase of one inch in the preceding 30 years through the use of earlier comparative data.

The mean weight for mothers was 120.62 pounds and for daughters, 124.62 pounds. Because of the increased variability in weights, 34.09 years would be required to make this increase on the part of daughters a significant increase (see Table 2 for weight by birth decades). The mean annual increase is .10 pounds with a range from .02 to .20 pounds. Earlier studies showed that Wellesley women are heavier than Oberlin and Nebraska women (1893-1902); other studies show that daughters in this study are heavier than Stanford, Wisconsin, and Minnesota college women (1895-1907). Weight increased similarly to stature, but it appears that it would take twice as long for an important change in weight to take place.

TABLE 3
Stature and Weight by Birth Decades

Year	Stature		Weight	
	Mean	Range	Mean	Range
1856-65	160.9	145-175	119.88	85-153
1866-75	160.69	148-175	120.45	85-185
1876-85	161.77	145-178	120.70	80-180
1886-95	163.30	148-175	121.65	80-160
1896-05	163.99	148-178	123.70	90-180
1906-15	164.98	151-181	125.25	75-190

Numerous other anthropometric measures were compared for mothers and daughters. Most of these were confined to 205 Wellesley mothers and their 241 daughters. Sitting height, girth of chest (at rest, at full expansion), girth of waist, hips, forearm and upper arm, breadth of shoulders, waist, and hips were the measures compared. Daughters showed actual increases over mothers in all measurements except breadth of hips. (These are the same general changes as were indicated for males.) However, the girth of the upper arm and breadth of shoulders and waist increased very slightly. The daughters, although taller and heavier, were more slender. The relative sitting height shows that the females were increasing more in trunk length in proportion to stature. (The reverse proportional increase is true of males.)

Weight and stature for sisters was compared. The differences between first-born, second-born, and third-born sisters in these data showed an apparent increase in both stature and weight with each successive sister. This increase was such that it could not be completely accounted for on the basis of annual increase; these results compare well with those obtained from a like comparison of brothers. W. W. Howell (4), in 1948, compared birth order with body size and found nothing among Wisconsin brothers to substantiate Bowles' indication that younger brothers had a constant size advantage over and beyond normal annual increase in stature. The slight degree found was too small to be reliable. A follow-up study on sisters was not found.

H. V. Meredith (5) in 1951 reported differences in stature and weight for male and female private school children, ages 6 to 16 years, for two successive decades (1920-27 and 1930-37). The differences in stature were slightly greater for females (2.1 cm.) than for males (1.7 cm.), and are highly significant in favor of the later decade. A similar result was obtained for weight differences. The average weight difference was three pounds, an amount greater than chance would allow in random sampling of data obtained on the same children. Meredith emphasizes that the fact of this biological trend should be distinguished from attempts to explain this fact causally.

It is necessary to look to European papers for more current reports on stature increases. A report by Holmgron (3) in 1952 on height of 46,000 Swedish men and women indicates that there was an increase for both sexes at all ages for the period 1914-30. Those aged 66-70 were much shorter than those aged 26-30. The author declares these differences in both sexes are due to "the older individuals belonging to a shorter generation" and are not ascribed to decline in height during aging of individuals. This increase in stature began at the latest in the middle of the 19th century and has continued without interruption. The total increases from 1850-1930 were 9.5 cm. for men and 6.5 cm. for women.

A British report by Durin and Weir (2) in 1952 on a direct comparison of parents and offsprings shows 76.2 per cent of women students taller than their fathers. Both differences are highly significant. However, these differences might be due to parental shrinkage. Therefore, the authors recorded differences for women only when such differences exceeded an inch (2.5 cm.). These differences were still significant at the 1 per cent level of confidence. The shrinkage of one inch attributed to the aging process for successive generations had been reported by English authors, Cathcart (1935) and Kemsley (1950). There is some concern whether apparent shrinkage is being confused with stature increases of second generations.

American scientists have attempted to unravel the above confusion by measuring long bones of cadavers. Trotter and Glaser (31) say there is a significant decline in stature with each age sample which is consistent for both sexes, whether Negro or white. They estimate this uniform decrement to be 1.2 cm. per 20 years. This amount is considerably less than the inch deducted in the above British report. Thus, there is general agreement be-

tween the more recent European studies and the older Bowles investigation of stature of women.

Women of Tomorrow

It is apparent that America gradually is becoming a nation of elders (1 in every 12 persons) and that a growing proportion of individuals over 65 years are women (21). In 1955 there were 116 females for every 100 males over 65 years old. By 1975 it is anticipated that the ratio will leap to 138 females per 100 males (18). The problem is accentuated by the rise in the number of widows since 1930. Over 12 per cent of the total population of women are widows and by 1960 it is estimated that there will be as many as 8½ million widows in the United States (30). (The proportion widowed is decreasing with the decline in mortality rates, but the total number is increasing rapidly because our aged population is increasing.) The oldster picture is complicated not only by the rapidly rising number of widows, but also by the anticipated frailty of women, the susceptibility to disabling and chronic illness. It appears that old women and their ailments will be an acute problem for future generations.

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Notes & Comments

NOTES

Football Officials Time-Expense-Income Study

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THE PURPOSE of the study was to investigate the time required to prepare for officiating, equipment costs, hidden expenses, travel, and the relationship of these factors to fees received. Members of the Ventura (California) County Football Officials Association served as subjects for the study. This association had 37 active members qualified to officiate football games.

A Time-Expense Study Form was prepared and distributed to the members. This form provided a systematic method for recording the activities involved in officiating. Specific information was sought on:

1. Officiating equipment purchases: (Shirt, jacket, shoes, whistle, membership dues, rule books, etc.)
2. Hours spent in:
   a. Individual study of the rules.
   b. Group study of the rules.
   c. Attending weekly association meetings.
   d. Officiating games (including travel time).
3. Cost of meals on extended trips (six or more hours).
4. Miles traveled at personal expense.
5. Fees received.

Forms were made available early in the fall at the time the *Football Officials Instructional Materials* were sent out by the parent Southern California Football Officials Association. Instructions were included with the forms describing their purpose and use. Time was taken during the first meeting of the Association to thoroughly discuss the purpose of the study and to explain how the data were recorded. To assure greater accuracy, members were encouraged to make entries on the form as the activity occurred. Reminders were also made at subsequent meetings.

Twenty-eight officials (75.6%) returned the completed forms. Three returns were rejected because information was improperly recorded.

Presentation of the Data

Table 1 reveals the data taken from the forms. Totals, means, and standard deviations appear at the bottom of the table.

Officials who participated in the study were classified depending on the years of service. Reference to the second column in Table 1 shows that ten men had one to five years' experience, and that five in this group were officiating for the first or second year. These officials were classified as novice officials. The remainder of the group, with one exception (number 11), had ten or more years' exprience. In the experienced group, eight men had been officiating football from 15 to 23 years. Other sections of Table 1 reveal the hours devoted to preparation for officiating, the expenses incurred relative to officiating duties, and finally the income realized for the services rendered.

Hours devoted to preparation. Two methods for studying rules were commonly practiced; individual home study and group discussions of rules, mechanics and interpre-

[1]This study was made when the author was Assistant Professor of Health and Physical Education, University of California, Santa Barbara College, Goleta, California.

TABLE 1
Raw Data from the Time-Expense-Income Study Form

No. of Cases	Years of Service	Games Worked	HOURS DEVOTED TO				EXPENSES			INCOME
			Individual Study	Group Study	Attending Meetings	Working Games	Equipment Purchases	Meals	Miles Traveled	Fees Received
1	5	16	2.5	3.0	24.0	66.0	$26.75	0.00	621	$214.50
2	5	8	3.0	6.0	19.5	33.0	7.00	$2.00	228	105.00
3	1	8	6.0	4.0	21.0	20.5	7.55	4.50	326	80.00
4	10	13	12.0	8.0	32.5	51.5	25.00	2.00	529	175.00
5	16	18	8.0	4.0	25.0	110.0	32.00	5.30	415	288.00
6	5	5	0.0	5.0	12.5	18.0	9.00	3.10	29	70.00
7	17	9	5.0	9.0	31.5	46.0	12.00	10.75	373	130.00
8	4	7	23.0	0.0	17.0	29.5	5.77	5.65	113	85.00
9	10	11	13.0	6.0	32.0	48.0	11.02	8.55	410	165.00
10	3	7	6.0	0.0	24.0	33.0	15.00	0.00	296	105.00
11	8	18	6.0	4.5	21.0	96.5	19.65	12.80	934	279.50
12	1	4	51.0	9.0	18.0	17.0	38.14	0.00	396	52.00
13	15	10	15.0	7.5	21.0	54.0	4.00	5.56	904	155.00
14	11	16	12.0	2.0	33.0	77.0	7.65	5.00	860	224.50
15	1	4	9.0	6.0	23.0	16.5	32.13	3.40	174	47.00
16	15	16	14.5	0.0	22.0	69.0	21.50	23.50	865	275.00
17	19	15	40.0	5.0	24.0	53.5	4.65	11.50	628	227.50
18	23	13	5.0	3.0	33.0	61.0	27.00	7.50	570	135.00
19	12	13	5.0	0.0	29.5	60.5	38.00	9.75	722	190.00
20	1	3	13.5	6.0	12.0	9.0	29.50	0.0	48	35.00
21	21	13	13.0	6.5	22.5	66.5	15.00	30.60	906	185.00
22	2	8	8.0	3.0	10.0	46.0	4.00	6.50	198	100.00
23	19	4	10.0	2.0	32.0	17.0	5.00	2.10	120	60.00
24	10	11	1.0	6.0	34.5	60.0	4.00	0.00	1374	160.00
25	10	15	29.5	12.0	33.5	93.5	40.50	26.25	324	152.50
Total	244	265	311.0	117.5	608.0	1252.5	441.81	186.31	12363	3695.50
Mean	9.7	10.6	12.4	4.7	24.3	50.1	17.69	7.45	494.5	147.82
			10.15	3.7	8.04	26.8	13.02	7.83	329.1	73.00

tations. The mean hours for these two items was 12.4 and 4.7 respectively, a mean total of 17.1 hours of study.

Further instruction and study was provided in the meetings of the association. These meetings of the entire officiating group featured special instruction in various aspects of officiating, demonstrations by experts, films, and a testing and evaluation program. Officials were required to attend six out of seven scheduled meetings. Mean attendance at meetings was 24.3 hours.

Several officials in the association devoted considerable time to planning meetings, preparing instruction, developing and administering tests, and correcting examination papers. A total of 124 hours were reported by officers of the association for these purposes. These hours were not considered in the computations, because it was felt that they were not a part of the usual training program.

The mean hours recorded in working games was 50.1. When an officiating assignment required an official to travel to another community, the travel time was included in the total hours recorded for that game. This was justified from two points of view. First, officials usually shared one car, and most of the travel time was devoted to discussing officiating. Second, excessive travel is not usually essential in most avocations. Officiating almost always involves traveling to another community. It was the practice of the association to assign games to men who did not reside in the community where the game was played. Therefore, officials were often required to travel and consideration of travel time is not unreasonable.

The total mean hours required to perform all tasks related to the training of officials and in working games was 91.5.

Analysis of expenses. Officials of the association had various expenses for dues, rule

books, uniforms, and other items. Often there was the necessity of replacing worn clothing or shoes. New officials often had to purchase a major portion of, or a complete, uniform. Purchases ranged from $4.00 to $40.50 with a mean cost of $17.69 per official.

Cost of meals on extended trips requiring more than six hours were recorded. A total expenditure of $186.31 was reported for meal expenses. The mean expense was $7.45. There was greater variation in these expenses than in any other item. Table 1 reveals that most of this expense was among the more experienced officials who did the greatest amount of traveling. The range of this item was from no expense to $30.60.

Total travel for the membership for 265 games, attending meetings, and other incidental travel total 12,363 miles. It was customary for officials to share transportation, and the games were assigned with consideration for minimum travel. The mean miles traveled by each official was 494.5. Travel allowances were seldom paid by the schools. These allowances were not recorded as income and the mileage for this trip was not included in the totals for the particular owner of the car. If a reasonable mileage allowance of 7¢ had been paid it would have amounted to $34.62. Since it was not paid by the schools, this amount was an expense to the officials.

Analysis of income. The officials reported a total income of $3,695.50 for 265 games. Fees ranged from $10.000 for junior varsity games to $22.50. The fee for league games was $15.00 and fees above this figure were for junior college or college games, few of which were assigned by the association. The mean fee was $13.95 per game and the mean total income for each official was $147.82.

Summary and Conclusions

When all of the factors of time, expense, and income are brought together, the following information was disclosed by the data.

Mean hours of preparation and games			$91.5
Mean expenses			
Equipment	$17.69		
Meals	7.45		
Travel	34.62	Total expenses	59.67
Mean gross income			$147.82
Mean net income (gross income minus expenses)			$88.06

When 91.5 hours (time devoted to preparation and games) is divided into the net income, it is seen that officials earned a mean stipend of 96¢ per hour for their work.

More startling results were disclosed when the figures for the novice and experienced officials were compared. When the data for these two groups were used to compute the hourly income in the same manner as was employed for the entire membership of the association, the following was revealed. Experienced officials, with eight to 23 years experience, earned a mean hourly income of $1.02. The novice officials earned only 83¢ per hour for their work.

Conclusions

Officiating high school football games is a task which requires practitioners to spend considerable time and entails unavoidable expenses. Fees paid for this service are so low as to result in an extremely inadequate profit for a service which requires such a high degree of technical skill. A more equitable fee, commensurate with the hours and expense and the technical skill required, needs to be given serious thought by school administrators, athletic directors and coaches.

Research Abstracts

Prepared by the Research Abstracts Committee of the National Council of the Research Section, PAUL A. HUNSICKER, Chairman

Health Education

72. ARNOLD, FRANCIS A., JR., D.D.S. Grand Rapids fluoridation study. *American Journal of Public Health*, **47**: 5: 539-545 (May 1957).

The purpose of this study is to report the results of ten years of fluoridation of a water supply and some of the health results. The study was designed to determine the prevalence of dental caries prior to fluoridation and to evaluate its effects by subsequent annual oral examinations. There are a number of tables with detailed figures on the number of children examined, caries, per cent reduction of caries, etc. On the basis of these results, one can conclude that fluoridation of public water supplies will effectively reduce the dental caries from birth onward. In all studies, findings show a reduction of 60-65% in the prevalence of caries in permanent teeth in children born subsequent to the change in water supply.—*Joseph E. Lantagne.*

73. DAIRY COUNCIL. Food and Industry. *Dairy Council Digests.* (Mar. 1957).

Of the calories consumed per person in the United States, 33% comes from concentrated fat and carbohydrate foods which provide less than 5% of any essential nutrient for which allowances are established; 33% comes from animal food products which supply 75% of our calcium, 66% of our riboflavin, about 66% of our protein, 50% of our niacin, 33% of our iron and thiamine, and 25% of our vitamin A. The other third of our foodstuff comes from plant food products and these supply 90% of our ascorbic acid, 66% of our vitamin A, about half of our iron and niacin, more than one-third of our riboflavin, and one-quarter of our calcium.

The primary dietary faults of industrial workers which influence health, work efficiency, and emotional stability are: inadequate breakfasts; consumption of high-calorie, low-nutrient snacks; and over-eating.—*Paul Hunsicker.*

74. DAIRY COUNCIL. Sodium restricted diets. *Dairy Council Digests.* (July 1957).

Restriction of sodium intake prevents accumulation of body fluids in certain diseases and reduces blood pressure in some hypertensive patients. Milligrams of sodium per day should be clearly stated in prescribed sodium restricted diets along with other desired alterations of diet. In long-range treatment, as much attention should be given to insuring adequacy of the diet as is given to its sodium content. Deficiencies of calcium, riboflavin, protein, iron, thiamine, niacin, and iodine are most likely to occur if milk, meat, eggs, and iodized salt are eliminated or severely limited in sodium restricted diets.—*Paul Hunsicker.*

75. DICKEL, HERMAN, and HENRY DIXON. Inherent dangers in the use of tranquilizing drugs in anxiety states. *Jour. of Amer. Med. Assn.* **164**: 422 (Feb. 9, 1957).

Over a period of about eight years, the authors had opportunity to study effects of tranquilizing drugs in 8,200 patients (anxiety the chief finding) who were referred to them for psychotherapy. In this group, the authors say, they found certain complications and dangers arising from widespread use of such drugs. These hazards could be grouped as (a) physical danger to the patient; (b) emotional, moral, and philosophical danger to the patient; (c) danger to medicine and the physician; and (d) danger to society.—*Medical Abstract Service.*

76. OKEY, R., and MARIAN LYMAN. Dietary fat and cholesterol metabolism. *Jour. of Nutrition*, pp. 523-533 (Apr. 1957).

The data indicate at least the possibility that, with a diet high in cholesterol, it may be of some importance whether the fat eaten is margarine, which consists chiefly of coconut oil, or one made up of cottonseed oil. With an almost cholesterol-free diet, differences in composition of dietary fat had little effect on liver and serum lipids until the proportion of fat in the diet was increased to such a level that the adequacy of the lipotropic factors (protein, methionine, and choline) was questionable.—*Paul Hunsicker.*

77. QUINN, ROBERT W., M.D., FLOYD W. DENNY, M.D., and HARRIS D. RILEY, M.D. Natural occurence of hemolytic streptococci in normal children. *Amer. Jour. of Public Health*, **47**: 8: 995-1008 (Aug. 1957).

This study was conducted in 1953-55 in Nashville, Tenn., a city of about 174,000 persons, with a mean range of temperature of 59°F. to 69°F. and an annual rainfall of about 46 inches. Third and fourth grade students were observed. Doctors visited the schools weekly and obtained throat cultures. Hemolytic streptococci were classified according to serological groups and types; carrier rates were determined; and certain epidemiological correlations were made. The carrier rates were highest in the best socioeconomic area. The degree of crowding in the home and school and meteorologic conditions did not seem to influence the carrier rates directly.—*Joseph E. Lantagne.*

Miscellaneous

78. GLUECK, SHELDON, and ELEANOR GLUECK. Working mothers and delinquency. *Mental Hygiene*, **41**: 327-52 (July 1957).

In this article the Gluecks present a detailed statistical study based on data from their book, *Unraveling Juvenile Delinquency*, in which matched samples of 500 delinquents and 500 non-delinquents were compared.

Data showed that about the same percentage of mothers in each group were employed. One significant differentiating factor, however, was that the working mothers of delinquents were more likely to work sporadically rather than regularly. This suggests the hypothesis that the mother who works occasionally does so to get away from household drudgery and parental responsibility and thus contributes to the delinquency of her children. The regularly employed mother seeks to supplement the family income and plans for the care of her children while she is away. An interesting sidelight was the finding that the employment of the mother had its most potent delinquency-producing effect on ectomorphic youngsters.—*Bruce L. Bennett.*

79. SCHIFFER, MORTIMER. A therapeutic play group in a public school. *Mental Hygiene*, **41**: 185-93 (Apr. 1957).

The author describes a play group project designed to help emotionally disturbed children in a public elementary school in New York City. A room with play equipment was set aside and problem children meet one hour a week in groups. The play groups are attended by an adult who is under the supervision of a person trained in group therapy and dynamics. There is no program or structrue to the sessions and interaction is spontaneous.

The behavior and progress made by three boys is described in some detail. The technique seems to be useful, although it is not a substitute for ultimate treatment or for alleviating deep-rooted symptoms.—*Bruce L. Bennett.*

80. METROPOLITAN LIFE INSURANCE CO. Fatal injuries in sports. *Statistical Bull. of the Metropolitan Life Insurance Co.*, p. 8-10 (Apr. 1957).

Among policy holders aged 10-64 years, there were more than 800 deaths in sports during the three years 1953-55. Males comprised 92% of the victims, reflecting the fact that many more males than females engage in sports, particularly the more hazardous ones.

The variations in death toll arise for the most part from differences in the number of participants in the individual sports and are not to be interpreted as measuring the comparative hazards associated with the various activities.

Water sports accounted for nearly half the deaths in this study. Of the 380 drownings in such recreational activities, 249 were due to swimming, 85 to wading or playing in the water, 40 to diving. The remaining few fatalities resulted from sports which have become popular in recent years—skin diving, water skiing, etc.

Pleasure boating accounted for close to a fifth (148) of the deaths in sports. Fishing claimed 153 lives. Other sports deaths were: hunting, 90; target shooting, 8; ice skating, 8; football, 5; climbing, 5; horseback riding, 4; baseball, 3; basketball, 2; boxing, 1; golf, 1; and ice boating, 1.—*Paul Hunsicker.*

Physiology

81. Benjamin, Fred B. The effect of pain on performance. *U. S. Armed Forces Medical Jour.*, p. 332 (Mar. 1957).

The results of the tests on voluntary subjects were: (1) Tests involving primarily memory and speed of performing various mental tasks are not affected by simultaneous pain. (2) Pain increases, up to 4 or 5 dols, appear to be independent of intensity. (3) In higher mental tasks, mistakes increase in rough correspondence with increase in pain intensity. (4) Time estimation is increased, which is considered overcompensation for apparently slow time passage in pain. (5) Pain impairs performance in muscular coordination tests, the interference apparently increasing with intensity and also refinement of the task. (6) Simple reaction time is not affected, but choice-reaction time is prolonged. (7) The mean amplitude of the patellar reflex is not significantly affected by pain, while the threshold of the skin-flare reaction is significantly raised. (8) In short tests of work performance, total work is not significantly altered by simultaneous pain, but efficiency, indicated by cardiovascular and respiratory changes, is significantly decreased.—*Medical Abstract Service.*

82. Dawber, Thomas R., M.D., Felix Moore, and George V. Mann, M.D. Coronary heart disease in the framingham study. *Amer. Jour. of Public Health* **47**: 4: 4-24 (Apr. 1957).

A continuing epidemiological study of heart disease was established in Framingham, Mass., during 1948-50 and was concerned with measurement and the extent of cardiovascular disease with persons aged 30-59 on Jan. 1, 1950. This study is expected to be continued for 20 years. The lab exam included measurement of vital capacity, height and weight, an electrocardiogram, a standard chest film, hemoglobin, glucose, uric acid, and serological test for syphilis. Many other chemical details were acquired from other examinations. The total sample was 6,510 persons, of whom 4,469 subjects were examined and a follow-up made. Tables have been worked out indicating the type of arteriosclerotic heart disease by age and sex and the number of subjects developing new disease in a four-year period. Since hypertension and obesity have been found to be correlated, the degree of fatness and the incidence of heart ailment was considered. Too, serum cholesterol studies were made. Arteriosclerosis heart disease was twice as prevalent in men as in women on first examination but was uncommon under 40 years of age. Almost half of the men developing heart attacks died and almost one-third of them died suddenly. The presence of high blood pressure among men 45 to 62 years was strongly indicated in new cases. Neither smoking habits or educational background were notably associated with the development of new cases.—*Joseph E. Lantagne.*

83. LIPPOLD, O. C. J., *et al.* The rhythmical activity of groups of motor units in the voluntary contraction of muscle. *Jour. of Physiology*, pp. 473-487 (Aug. 1957).

Muscle action potential records from human subjects during voluntary activity often show a tendency towards grouping of action potentials. The frequency of such groups is usually about 9 per second. These groups are present in all muscles, being more prominent when contraction strength is low and varying in different subjects.

The tendency towards grouping is increased by local fatigue, by extension of the muscle either passively or during its active contraction, and by previous voluntary contraction. It is reduced by cooling the muscle.

The frequency of the groups is subject to spontaneous variations about its average level. It is increased by voluntary contraction, by stretching the muscle, and by fatigue, while it is decreased by cooling the muscle.—*Paul Hunsicker.*

RESEARCH PAPERS

All interested persons are invited to submit research projects which may be read before the Research Section of the 60th National AAHPER Convention in Kansas City, March 30-April 3, 1958. Research on any aspect of health, physical education, or recreation will be considered.

Projects should be submitted in finished form or at least in sufficient detail to permit the evaluating committee to determine the nature of the problem, its purpose, methodology, and treatment of data employed, and the results.

Deadline date for papers to be received is January 1, 1958. Send all papers to the Chairman-elect of the Research Section, Warren R. Johnson, College of Physical Education, Recreation and Health, University of Maryland, College Park.

FUNDS FOR FITNESS RESEARCH

THE AAHPER Board of Directors is attempting to survey ways in which funds for significant research on fitness and related subjects can be secured. Although no funds have been obtained to date, various foundations and other sources are to be approached.

Submitting Plans

All persons who are in need of funds to bring their research problems to completion are encouraged to submit their plans to the AAHPER Research Council's Committee on Research Projects for evaluation. Selected projects will serve as a guide for soliciting needed funds.

Use of Outline

When submitting research plans, please use the following outline so that the committee may gain an accurate idea of the project and of the funds needed to bring it to completion.

Where to Send Plans

Please send all project plans to the committee chairman, Warren R. Johnson, University of Maryland, College Park, Md. Other Research Project Committee members are: John M. Cooper, University of Southern California, Benjamin Massey, University of Maryland, Henry Montoye, Michigan State University, Lawrence Rarick, University of Wisconsin.

Research Council Help

Persons wishing assistance in drawing up their project plans may consult with any Research Council member or contact Marjorie Phillips, president of the Research Council, Indiana University, Bloomington, Ind.

Outline for Research Plan

1. Nature of the Request
   - (a) Orientation to the Problem
   - (b) Need for Financial Support
     - (1) Present status of the project.
     - (2) Present financial support, if any.
     - (3) Present facilities and equipment, if any.
     - (4) Need for supplementary funds to continue or complete the research.
2. General Purpose of the Study
3. Background and Applications of the Investigation
   - (a) Significance of the study in the light of related investigations.
   - (b) Present status of knowledge on the problem.
   - (c) Practical or functional importance of the study.
4. Design of the Investigation
   - (a) Specific problems under investigation (hypotheses to be tested).
   - (b) Methodology (including specific procedures, instrumentation, subjects and kinds of data to be collected).
   - (c) Treatment of data.
   - (d) Expected outcomes.
5. Budgetary needs
   - (a) Personnel (secretarial help and research assistants).
   - (b) Special services (technical and statistical services).
   - (c) Instrumentation or special facilities.
   - (d) Materials and supplies.
   - (e) Pay for subjects.
   - (f) Travel.
   - (g) Insurance.
   - (h) Publication.
6. Endorsement of Project by Organization
7. Advisors and Consultants
8. Overview of Investigator's Experience in Research.

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Maryland	(3)	Rhode Island	(2)
Massachusetts	(4)	Vermont	(1)

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Indiana	(4)	West Virginia	(2)
Michigan	(6)	Wisconsin	(4)

Northwest District

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Montana	(1)	Washington	(3)

Southern District

Alabama	(2)	North Carolina	(3)
Arkansas	(2)	Oklahoma	(2)
Florida	(4)	South Carolina	(2)
Georgia	(3)	Tennessee	(2)
Kentucky	(2)	Texas	(6)
Louisiana	(3)	Virginia	(3)
Mississippi	(2)		

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